# PLANT BREEDING ABSTRACTS

**Vol. XXIX, No. 4**
**(Abstracts Nos 3330—4720)**

**Compiled from World Literature**
**by the**

## COMMONWEALTH BUREAU OF PLANT BREEDING AND GENETICS

**1 October, 1959**

**Commonwealth Agricultural Bureaux,**
**Farnham Royal, England**

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# Plant Breeding Abstracts

Vol. XXIX, No. 4

C. A. B.
19 NOV 1959
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## STATISTICS

3330 WANG, C.-M.
**(Theoretical bases for the statistical treatment of percentages).**
Chung-hua Nung-hsueh Hui Pao/J. agric. Ass. China 1958 : No. 24 : 1–9. [Chinese].

This mathematical discussion is principally concerned with establishing general principles on which to base the square-root transformation of Poisson variates and the arc-sine transformation of binomial variates prior to analysis of variance.

3331 KÖHLER, D.
Eine einfache Methode zur Genanalyse bei kontinuierlicher Variation. **(A simple method for gene analysis in continuous variation).**
Z. Pflanzenz. 1959 : **41** : 65–71.

A method of gene analysis suitable for progenies showing continuous variation is described with reference to examples of monohybrid and dihybrid inheritance. The method is based on the summation of percentages of frequency classes.

3332 PAYNE, L. C.
**Probability theory and genetics.**
Abstr. Diss. Univ. Camb. 1956–57 (1959) : 27–28. (Abst.).

After a general survey of the role of probability theory in science, the following applications are considered. (1) An explicit expression is obtained for the joint probability of there being exactly $r_1$, $r_2$, . . . , $r_n$ exchange points after meiosis in $n$ segments of a finite strand. (2) A matrix calculus is developed for evaluating the map distance and recombination fractions for any combination of segments on a finite arm. (3) Intercept distribution is analysed along the lines already reported [XXVI, 1950 and XXVII, 3628]. (4) Arising from (3), a general class of so-called segmental functions is defined and described. (5) The fiducial distribution of the common mean of two normal populations having unknown variances is calculated.

3333 ROJAS, B. A.
**The analyses of groups of similar experiments.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3014 : p. 415. (Abst.).

The following topics were among those considered: (1) analysis of groups of experiments with homogeneous experimental error variances and unequal numbers of replicates; (2) the effect of heterogeneity of the error variances; and (3) analysis of variance when the error variances follow a gamma distribution.

3334 BOGUSLAWSKI, E. v.
Der Feldversuch mit polyfaktorieller Fragestellung. **(The polyfactorial field experiment).**
Z. landw. Vers.- UntersuchWes. 1958 : **4** : 316–42.

The various types of layout that have been used in Germany and elsewhere to deal with polyfactorial experiments are compared. The author prefers the yield-area method, elaborated by himself, and regards it as superior in some respects to the lattice designs to which it bears some resemblance.

3335 HÄNSEL, H.
Die Verwendung der Variationsbreite bei der Schätzung der Standardabweichung und bei der Varianzanalyse ungeordneter Blockanlagen, sowie eine weitere Vereinfachung des Hartley'schen Verfahrens durch direkte Bestimmung von Grenzdifferenzen. **(The use of range in estimating the standard deviation and in the analysis of variance of randomized blocks, also a further simplification of Hartley's method by direct estimation of limiting differences).**
Bodenkultur 1959 : **10** : 148–58.

Rapid methods for determining the standard deviation from sample size and range are described and Hartley's method [cf. XXI, 1457] is explained by means of an example. A simplification of Hartley's method involves the use of $d$ factors, based on Hartley's $c$ values; when the sum of the ranges is multiplied by the appropriate $d$ value, the 5% limiting difference is obtained directly. A series of graphs are provided from which the appropriate limiting difference may be read for range sums of 0–1000 for experiments with 3 to 6 blocks and 4 to 9 treatments.

3336 YANG, S.-J.
**(A method of raising the degree of precision of trials involving a check variety and other varieties).**
Nung-yeh-hsueh Pao (J. Agric.)/Act. agric. sin. 1958 : **9** : 291–93. [Chinese].

The method described involves the use of

randomized-block or lattice designs in which one variety, represented in 2–3 plots per replicate, is used as the standard against which the others are compared.

3337 KISHEN, K. & SRIVASTAVA, J. N.
**Confounding in asymmetrical factorial designs in relation to finite geometries.**
Curr. Sci. 1959 : **28** : 98–100.

Bose and Kishen [XI, 850] solved the problem of confounding in factorial designs of type $S^m$ by representing each treatment combination by a finite point of the associated $m$-dimensional projective geometry $PG$ $(m,s)$ constructed from the Galois field $GF(s)$. In the present paper, the problem of confounding in factorial designs of type $S_1 \times S_2 \times \ldots \times S_m$ is treated by using curvilinear spaces or hypersurfaces and truncating the $EG$ $(m, s)$.

3338 MACK, A. R. & CAIRNS, R. R.
**Statistical procedures: A.**
Illustration Stations Division, Central Experimental Farm, Ottawa, Ontario. 1959 : 2nd Ed. Pp. 14+ 29. (Mimeographed).

The analysis of the following experimental designs is described and exemplified: randomized block designs for 2x2x2 and 3x3x3 factorial experiments, and confounded factorial designs for balanced and partially balanced 4x4 experiments, and for 2x4x2 and 3x3x3 experiments. Missing-plot technique in partially confounded factorial analysis is also treated.

3339 **Statistical procedures: B.**
Illustration Stations Division, Central Experimental Farm, Ottawa, Canada 1959 : 2nd Ed. : Pp. 26. (Mimeographed).

A detailed account is given of the analysis of a balanced lattice design involving 16 treatments and 5 replications, a partially balanced lattice design involving 16 treatments and 4 replications, and rectangular lattice designs involving 20 or 30 treatments.

3340 WALPOLE, R. E.
**Combined intra- and inter-block analysis for factorials in incomplete block designs.**
Virginia J. Sci. 1958 : **9** : p. 448. (Abst.).

The treatment by Kramer and Bradley [XXVIII, 1111] of factorials in incomplete block designs is extended to include "the several suitable classes of two-associate class, partially balanced incomplete block designs, that have not at present been considered in the literature."

3341 GLENN, W. A. & KRAMER, C. Y.
**Analysis of variance of a randomized block design with missing observations.**
Virginia J. Sci. 1958 : **9** : 451–52. (Abst.).

Equations have been derived for all cases in which not more than 3 values are missing and for any number of missing values, given that no 2 values are missing in the same block or treatment or given that all the missing values are in a single block or treatment. A procedure for the completely general case is proposed involving the inversion of a symmetrical matrix of order equal to the number of missing values.

3342 GLASS, S. & KRAMER, C. Y.
**Analysis of variance of a Latin square design with missing observations.**
Virginia J. Sci. 1958 : **9** : p. 452. (Abst.).

A method of analysing a Latin-square design is described for the case where only one missing plot appears in any row, column or treatment or where all the missing values appear in the same row, column or treatment.

3343 OLIVEIRA, A. J. DE
**Analysis of a group of experiments on oats. II. Incomplete data.**
Agron. lusit. 1958 : **20** : 155–76.

Further to the first paper of this series [1432] on the analysis of oat trials lacking uniformity in design, number of replications, constancy of treatment, orthogonality or experimental error, an iterative method of fitting constants to deal with missing data for nonorthogonal experiments replicated over years or over locations and years is described.

## GENETICS

3344 VALDEYRON, G.
Quelques aspects de la génétique et de ses rapports avec l'amélioration des plantes. **(Some aspects of genetics and of its relations with plant improvement).**
Tunis. agric. 1959 : **60** : 1–9.

This review covers the work of Mendel and Morgan and also deals with mutations in relation to breeding.

3345 DUBININ, N. P.
Problemele şi sarcinile geneticii radiaţilor. **(Problems and aims of radiation genetics).**
An. Romîno-Soviet. : Ser. Biol. 1957 : No. 2 : 81–95.

[Cf. XXVII, 1105].

**Exchange of genetic material : mechanisms and consequences.**
Cold Spring Harbor symposia on quantitative biology. New York, 1958 : **23** : Pp. 433.

The contributions most likely to be of interest to plant geneticists and breeders are summarized below.

3346 *Meselson, M. & Stahl, F. W. The replication of DNA.* (*pp. 9–12*).
A transfer experiment with *Escherichia coli*, already reported [124], is further discussed. It is interpreted as supporting the Watson-Crick hypothesis of DNA replication.

3347 *Freese, E. The arrangement of DNA in the chromosome.* (*pp. 13–18*).
The following hypothesis of chromosome structure is advanced. The DNA molecules are arranged in single unbranched monolinear sequence. The genetic information of a chromosome is assumed to reside in only one of the early-interphase DNA strands, otherwise the appearance of point mutations becomes difficult to account for. Since the putative molecular weight of DNA (ca. 10 million) is a very small portion of the total DNA of a chromosome, it is suggested that the DNA strands consist of alternating segments of DNA and "connecting units" of unspecified chemical constitution. It is assumed that the DNA molecules are attached to the connecting units by a single bond so that free rotation around this bond is possible during the unwinding of the DNA helices during replication.

3348 *Hershey, A. D., Steinberg, C. & Stahl, F. The production of recombinants in phage crosses.* (*pp. 19–46*).
The main portion of this paper comprises a detailed discussion by the first author of the following topics: mating frequency, nature of the phage "chromosome", pairwise *v.* group mating, heterozygosis, recombination and negative interference. The fact that multiplicity reactivation of ultraviolet-irradiated phage is accompanied by very high recombination frequencies provides evidence in favour of a copy-choice mechanism of recombination and of group rather than pairwise mating. Special consideration is given to the phenomena of partial heterozygosis and high negative interference; it is suggested, by way of explanation, that mating brings about the production of short biparental segments, which remain associated for one or more generation times but eventually separate, and that more than one switch can occur in each mating segment. The average number of switches per segment would be of order 1, the mating segment being about 10 map units long and the entire chromosome 250 units.
In the first appendix to the paper, the first author discusses the relation between recombination frequency and heterozygote properties, (1) excluding and (2) assuming high negative interference.
In the second appendix, the last two authors present a formal genetic treatment of pair mating, group mating and a more general theory including the first two cases as special instances.

3349 *Anderson, T. F. Recombination and segregation in* Escherichia coli. (*pp. 47–58*).
The results from an analysis of families originating from $F^-$ bacteria after conjugation with an $F^+$ strain (Hfr) carrying markers for biochemical and physiological properties provided evidence that (1) the transferred marked fragment of the Hfr chromosome may persist in a single line descended from the $F^-$ zygote for many divisions and during this period may recombine a number of times with the $F^-$ genome, (2) recombination involves a process of replication which conserves the injected fragment of the Hfr chromosome, (3) the original linkage between the Hfr markers entering the $F^-$ receptors is largely lost before or during recombination, (4) many recombinants are nonviable and (5) the number of recombinants derived from a single $F^-$ conjugant may be limited by the loss of the Hfr fragment in a nonviable bacterium.

3350 *Demerec, M., Goldman, I. & Lahr, E. L. Genetic recombination by transduction in* Salmonella. (*pp. 59–68*).
Use was made of alleles at the five closely linked loci *try-A*, *try-B*, *try-C*, *try-B* and *cys-B* in transduction experiments [cf. XXVIII, 3951]. Of 31 possible classes of recombinants, 26 were recovered. Evidence was, however, obtained that the remaining five occurred although the experimental scheme was such that they could not be detected. The mode of formation of recombinants in transduction experiments is interpreted in terms of a copy-choice model, which is a modification of the model proposed by Belling for crossing over. It was evident from the data that replacement of chromosomal portions in a recipient bacterium by homologous portions of a transducing fragment took place with a much greater frequency than crossing over in higher organisms. It is however suggested that exchange during transduction

and crossing over are due to similar processes, some factor, such as the closeness of synapsis possible during transduction, being responsible for the frequent multiple crossing over within short regions.

3351 *Plough, H. H. Linear order of gene loci in* Salmonella *in relation to prophage site.* (*p. 69*).

Cases of transduction have been encountered which may be best explained by assuming that the phage takes up chromosomal fragments of the bacterium at random but that the attachment or crossing over bears a relationship to the position of the prophage site. It appears that crossing over or transduction is likely to occur in inverse relation to the nearness of the prophage site.

3352 *Luria, S. E., Fraser, D. K., Adams, J. N. & Burrous, J. W. Lysogenization, transduction, and genetic recombination in bacteria.* (*pp. 71–82*).

Evidence is presented pointing to some fundamental similarities between the processes which lead to integration of the phage genome as prophage in the bacterial chromosome in lysogenization and those leading to the integration of components of the bacterial genome transferred by transduction, transformation or mating. In each of these four types of what may be regarded as infective heredity, the first result is an unstable heterogenote giving rise to progeny segregating into the unchanged recipient type as well as stable and unstable types carrying the extraneously derived traits. Genetical aspects of the "decision" of a phage-infected cell whether to be lysed or to give rise to a phage-carrier clone are discussed. It is concluded that (1) the phage genome actively controls functions necessary for lysogeny, (2) the lysogenic decision requires fulfilment of the critical functions before some irrevocable step to maturation and lysis, but not necessarily before vegetative multiplication of the phage genome, and (3) the decision not to lyse is not equivalent to persistent lysogeny. Results from single-cell pedigrees of *Salmonella typhimurium* revealed the occurrence of a transitional prelysogenic phase in which the phage genome differs in its properties and relationship with the bacterial genome as compared with the established prophage condition or in vegetative multiplication. These results gave evidence of a protracted period of instability during which the phage determinants are able to multiply but are not yet fully established as prophage. Such a transitional state is evident in the other three types of infective heredity, as indicated by data on segregation. In addition, the frequent loss of phage determinants during the prelysogenic condition contrasts with the rare loss of prophage from stable lysogenic bacteria. The greater instability of the phage determinants in the prelysogenic stage may be due to lack of attachment or to different physical properties. Finally, it is suggested that it may be possible to interpret in a unified way all phage-associated transfers of cellular characters in bacteria, on the basis of prophage effectiveness. Abortive transductions may result from the transfer of fragments of the bacterial genome associated with phage determinants so defective that they cannot multiply. If the phage determinants are able to multiply but are impaired in their ability to persist as prophage, cases of transduction may occur which may involve replacement of a defective segment in the phage genome by a homologous part of the bacterial genome, as in the *λ-Gal* system in *Escherichia coli*. If the prophage carrying host characters is not defective, "conversion" of host characters, such as somatic-cell antigens, may be observed.

3353 *Campbell, A. The different kinds of transducing particles in the λ-gal system.* (*pp. 83–84*).

By means of the *hd* marker system, evidence has been obtained that the λ particles responsible for the transduction of the *gal* region consist of different types. The heritable disparities between the particles were established sometime before the isolation of the primary syngenotes. It is not yet known whether the different types of syngenotes represent crossing over at various points within a region of homology between the phage chromosome and that of the bacterium or whether they result from chromosomal rearrangements.

3354 *Hotchkiss, R. D. & Evans, A. H. Analysis of the complex sulfonamide resistance locus of pneumococcus.* (*pp. 85–97*).

The authors give further information on the behaviour of the above locus in transformation experiments and discuss the general implications of the results [cf. XXVIII, 2539]. "A stable, highly sulfonamide-resistant mutant of pneumococcus, isolated from a single selection step, shows a complex resistance locus. As donor in transformation, its DNA can transfer the full resistance, but more often disseminates only portions of the linear three-part sequence of linked markers, *adb*. Six transformant types

can be recovered containing different combinations of the unit markers, *a*, *d*, and *b*.

"Each of these unit markers determines a unique phenotypic level of sulfonamide resistance, and each maintains its identity in all combinations with others, being separable again by transformation. The phenotypes are also recognizable in combinations, but when unit genotypes are added to each other, the unit phenotypes in terms of tolerated drug concentrations become multiplied factorially. This close interrelation, and the common response of all phenotypes to para-amino-benzoic acid (PAB), indicate that a single cellular enzyme is undergoing modification. The most precise definition of the phenotypes is made in terms of their quantitative abilities to synthesize folic acid from PAB in presence of competitive analogs. These can be expressed as relative affinity constants of the enzyme for analog and substrate. Use of systematic chemical variants of the substrate as inhibitors has begun to reveal specific chemical features of the profile of the active center of the enzyme which are modified under the control of the unit regions of the DNA.

"Frequency ratios of the different genotypes produced by transformation of wild type cells by DNA from *adb*, indicate the linkage and that the most common transformations result from capture or copying of a small segment of the foreign DNA. The initial attack or switch from one DNA strand to another may be randomly determined within a class of available sites, available by reason of specific structural features, but the position of the switchback or counterattack is not random, being usually close to the site of original attack. The probability of the counterattack, if not of both, is influenced by environmental conditions affecting metabolism of the host cells, and perhaps also by the degree of homology of the competing DNA strands.

"Size limitations of this sort may restrict the extent of transfer whenever recombination occurs between molecular strands of DNA. They would tend to lead to such anomalies as imperfect additivity of map intervals, high negative interference, and non-linearity of the frequency scale. Anomalies of this sort observed in recent work with phage and other microorganisms, and within localized genetic regions of organisms behaving more classically, might be brought about by such restrictions on randomness. It is suggested that most nonreciprocal recombinations are those which occur at a molecular level between parts of free or chromosome-bound DNA molecules."

3355 *Austrian, R., Bernheimer, H. P., Smith, E. E. B. & Mills, G. T. Acquisition of new capsular type by pneumococcus, a multifactor transformation.* (*pp. 99–100*).

Transformation of the noncapsulated mutant of pneumococcus type III to capsular type I by DNA of the latter was accompanied by a minimum of three new biochemical activities on the part of the transformed cell: oxidation of uridine pyrophosphoglucose to uridine pyrophosphoglucuronic acid (UPPGA), epimerization of UPPGA to uridine pyrophosphogalacturonic acid and polymerization of type I capsular polysaccharide. The finding that capsular transformation requires the acquisition of multiple synthetic abilities and by inference the introduction of a relatively large unit of DNA may account for the low frequency of its occurrence in comparison with that of the acquisition of other characters, such as drug resistance, by transformation. In addition, it was found that an intermediary product of one synthetic pathway (type I polysaccharide) may be diverted into a second pathway (type III polysaccharide) and be utilized in the formation of the end-product of the latter. The genetic determinants of synthesis of a specific polysaccharide behaved as though they were closely linked, whereas linkage between the genetic determinants of the two capsular components of doubly capsulated strains was much less stable.

3356 *de Serres, F. J. Recombination and interference in the* ad-3 *region of* Neurospora crassa. (*pp. 111–18*).

The frequency of recombination affecting the *ad*-3 region and very closely linked markers [cf. XXVII, 1093] was increased by introducing modifiers into the mutant parents. In one group of crosses the *ad*-3 mutants were derived from the same wild-type strain while in the second group they originated from different wild-type strains. In the first group, a proportional increase occurred in the frequencies of (1) prototrophs with a classical cross-over combination of markers and (2) so-called exceptional prototrophs with either a parental combination of markers or the reciprocal-recombination genotype. In the second group, disproportionate increases in the frequencies of the two classes were detected; the frequency of adenine-independent progeny with the expected cross-over genotype underwent an increase whereas the frequency of exceptional prototrophs arising through nonreciprocal recombination decreased. Indication of considerable

positive interference and of high negative interference was therefore obtained from the second and fifth groups respectively. It is suggested that these results may be explained on the basis of the switch theory of crossing over. It is assumed that the length of the switch region is dependent on the structural heterozygosity of the *ad*-3 region and that mutants derived from different wild-type strains are structurally heterozygous with respect to the *ad*-3 region. The average length of the switch region would then be considerably shortened in crosses between *ad*-3 mutants of different origin, with the consequence of reduction in the frequency and the proportion of exceptional prototrophs. The view is however expressed that the results may be equally well explained according to an exchange mechanism with a side-chain model analogous to the structural models proposed by Schwartz [cf. XXV, 821] and Taylor [cf. XXVIII, 69]. In conclusion it is stressed that data on prototrophs obtained from crosses involving closely linked markers do not in any case necessitate postulating two distinct mechanisms to explain nonreciprocal and reciprocal recombination. What is required instead is revision of the classical concept of crossing over.

3357 *Case, M. E. & Giles, N. H. Recombination mechanisms at the* pan-2 *locus in* Neurospora crassa. (*pp. 119–35*).
[Cf. XXVIII, 3652].

3358 *Catcheside, D. G. & Overton, A. Complementation between alleles in heterocaryons.* (*pp. 137–40*).
A complex pattern of functional complementation in heterocaryons has been found among 40 *arg*-1 and 46 lysine-requiring mutants of *Neurospora crassa*. Cases of absence of complementation in heterocaryons of mutants for various loci are also noted. The *arg*-1 mutants, with which the paper chiefly deals, were divisible into six groups on the basis of complementation and the lysine-requiring ones into at least six and possibly seven groups. Reasons are given for rejecting as untenable the hypothesis that the *arg*-1 locus is a complex one consisting of several physiologically distinct portions or that some of the mutants carry suppressors which are specific in their action on other mutants. No progress has been made in obtaining recombination data from interallelic crosses. The following interpretation of complementation is suggested as the most plausible. In heterocaryons of, say, mutants belonging to the B and D complementation groups, two types of gene-derived unitary templates, B and D, may occur, each determining its characteristic product, a B or D type of polypeptide chain. "It is further presumed that one stage in the shaping of the enzyme is the aggregation of at least two of these products. In some cases, by chance, the aggregation will involve heterologous products. Other stages in the final shaping of the enzyme are likely to involve specific folding. Presumably, any one mutant has a defect which results in a fault in folding and so in the formation of a protein sufficiently different from the enzyme as to lack its specific activity. However, the difference is often small enough for the mutant protein to be serologically homologous with the enzyme. There are various ways in which interaction at this level might lead to complementation, i.e. to restoration of activity. One is a co-operation in the direction of the process of folding in a mixed aggregate. This could be competitive between the normal and the abnormal at each point, or perhaps random. The variation in degree of complementation could be explained by differences in competitive power. On this interpretation, total lack of complementation would correspond to complete dominance of the abnormal, over the normal, control at a given point. A second way could lie in the patterning of the folds, but it is difficult to understand on this interpretation why so few pairs of mutants should complement one another. The occurrence of complementation is fairly widespread but not universal. The absence of complementation could be taken to indicate that the enzyme is shaped from a single polypeptide chain, whereas the presence of complementation indicates the aggregation of two or more chains."

3359 *Roper, J. A. Nucleo-cytoplasmic interactions in* Aspergillus nidulans. (*pp. 141–54*).
As already briefly reported [cf. 39 and 1087], serial subculture in a medium containing acriflavine led to a stable morphological modification in three out of the four acriflavine-resistant strains of *A. nidulans* treated in this manner. The three variants, designated mycelials, failed to differentiate and to produce conidia or perithecia. It is regarded as likely that the variants were the result of induction by acriflavine and not of its selective action. Each mycelial, when combined in heterocaryotic association with a normal strain, transmitted the mycelial determinant. The heterocaryotic transmission was invariably unidirectional, no normal colonies being obtained from conidia with nuclei of

the mycelial component. These findings may be interpreted on the basis of (1) a transduction-like process involving a nuclear component or (2) the transmission of a cytoplasmic determinant with a suppressive effect on the wild-type cytoplasm and probably situated near the nuclear membrane and rarely, if ever, dissociated from it. The second hypothesis is tentatively adopted. Comparison of the phenotypes of the three strains produced by combining a common genotype with each mycelial determinant demonstrated that the three mycelial variants represented different cytoplasmic changes. Ascus analysis of a cross of mycelial 1 x normal revealed an overall 3 : 1 ratio of mycelial: normal. All the ascospores carried the mycelial determinant, segregation being attributed to the presence of two recessive genes for the expression of mycelial. One of these genes (*m*1) has been located to the left of *pro*-1 and *paba*-6. Mitotic analysis of heterozygous diploids has confirmed this position of *m*1 and suggested a situation for the second gene (*m*2). The mycelial phenotype is thus produced by the joint action of the mycelial determinant, interpreted as a cytoplasmic state, and an appropriate genotype. In addition, the data have suggested that the mycelial phenotype may be modified by the pleiotropic action of other nuclear markers, such as those determining nutritional requirements.

3360 *Roman, H. & Jacob, F. A comparison of spontaneous and ultraviolet-induced allelic recombination with reference to the recombination of outside markers.* (*pp. 155–60*).

When recombined, the recessive mutant alleles $i_a + i_b$ for isoleucine requirement in yeast interact so that the effect of the dominant allele *I* is produced. The spontaneous rate of such allelic recombination in heteroallelic diploids was about 20 per $10^6$ cells per cell generation, while the frequencies of spontaneous reversion to the dominant condition in homoallelic diploids was less than 0·5 per $10^4$ cells. Analysis of spontaneous reversals in asci derived from the heteroallelic diploids indicated that allelic recombination resulting in *I* was the consequence of nonreciprocal combination, as had been previously found to be the case for reversions at several loci for adenine requirement [cf. XXVII, 3647]. Ultraviolet irradiation increased the rate of allelic recombination in heteroallelic diploids 30–35 times at a survival rate of 80–90%. The greatest increase, about 200-fold, occurred in an irradiated culture with 27% survival. Observations on the effect of ultraviolet radiation on homoallelic diploids indicated that this agent induced reversion to isoleucine independence but at a rate which was not important in relation to allelic recombination. Reversals to *I* arising in heteroallelic diploids were then tested for evidence of recombination of outside markers at the histidine-1 and tryptophane-2 loci, between which *i* is situated. In the case of spontaneous reversals, recombination of outside markers occurred with a high frequency, a sizeable proportion of the recombinants requiring multiple exchange for their explanation, but this high frequency was not found among the induced reversals. Evidence from control experiments showed that selection for or against *I* reversals and for and against histidine-requiring and tryptophane-requiring reversals in the medium used (yeast extract - peptone) was not appreciable. The results from the investigations with ultraviolet radiation therefore indicated that recombination of outside markers and allelic recombination are not obligatorily associated. Their separation may be interpreted on the basis of a single model such as that proposed by Freese [cf. XXVIII, 3656]. According to this model, ultraviolet treatment would change the modality of reciprocal partner-exchanges in the region of nonreciprocal recombination, so that no such exchanges or an even multiple would occur much more frequently than single or odd multiples. A constraint is required to ensure that the replicating strand alternating between the two parental strands finishes replicating on the strand on which it begins to do so. The authors however prefer to postulate that two distinct processes are involved, one in outside-marker recombination, presumably reciprocal, and the other in allelic recombination. It is suggested that allelic recombination is characteristic of DNA recombination whereas reciprocal recombination is characteristic of other material, e.g. protein. If this hypothesis is accepted, the constraint required in the case of nonreciprocal recombination in the Freese model need not be assumed, and may be avoided by postulating a chromosome structure in which DNA branches off a protein backbone, as suggested by Schwartz and Taylor.

3361 *Leupold, U. Studies on recombination in* Schizosaccharomyces pombe. (*pp. 161–70*).

"Meiotic and mitotic formation of rare prototrophic recombinants which has been observed in pairwise crosses of eleven allelic adenine

mutants, is characterized by a roughly additive behaviour of the prototroph frequencies measured, thus suggesting that the prototrophs formed in these crosses are the result of an intragenic exchange, the frequency of which reflects the varying distances between different mutational sites of a linear cistron. Attempts to demonstrate the simultaneous formation of two reciprocal types of recombinants per recombination event, to be expected in the hypothesis that recombination is accomplished by classical crossing over, have not been successful so far, indicating that the intragenic recombination observed may be of an unknown, non-reciprocal type.

"The meiotic formation of rare homothallic recombinants which has been observed in crosses of heterothallic strains of the mating type + and −, on the other hand, has been shown to be the result of a regular crossing over event which exchanges two different but closely linked loci or sites cooperating in the determination of the mating reaction, and which leads to the simultaneous formation of two reciprocal recombinant types, one differing from both parents by its homothallic mating behaviour, and the other one being distinguishable from the heterothallic parent of the mating type + only by its genetic behaviour in mutation and recombination."

3362 *Weinstein, A. The geometry and mechanics of crossing over.* (*pp. 177–96*).

An exposition is given of multiple-strand analysis as applied to the distribution of exchanges among the chromatids of a tetrad, the lengthwise distribution of exchanges along the chromatids and sister-chromatid exchanges with special reference to criticisms of current theories of crossing over put forward by Shult and Lindegren [XXVII, 1026 and XXVIII, 2571].

3363 *Gerstel, D. U. & Phillips, L. L. Segregation of synthetic amphidiploids in* Gossypium *and* Nicotiana. (*pp. 225–37*).

Data are given on segregation ratios with respect to various loci in *Gossypium* in (1) amphidiploids of species from different sections, (2) intrasectional amphidiploids and (3) synthesized hexaploid hybrids combining natural tetraploid and diploid progenitor species [cf. XXVIII, 4445]. Group (1) comprised amphidiploids of *G. arboreum* x *G. thurberi* [2(A x D)], Old World species x *G. anomalum* [2(A x B)] and *G. hirsutum* x *G. anomalum* [2(AD x B)]. The second consisted of *G. arboreum* x *G. herbaceum* [$2(A_1 \times A_2)$] and *G. thurberi* x *G. raimondii* [$2(D_1 \times D_5)$], and the third of *G. hirsutum* x Old World species [2(AAD)], *G. hirsutum* x *G. raimondii* [2 (ADD)] and *G. hirsutum* x *G. thurberi* [2(ADD)]. Amphidiploids in group (1) yielded very wide ratios, such as 446 : 5 for locus $Y_c$ in Old World species x *G. anomalum* and 346 : 1 for $R_1$ in *G. hirsutum* x *G. anomalum* or in the case of three loci failed to segregate at all. In group (2), a 5 : 1 ratio was obtained for four out of the five loci tested in *G. arboreum* x *G. herbaceum*. Regarding the fifth character, leaf colour ($R_2$), for which three gamete classes, $R_2R_2$, $R_2r_2$ and $r_2r_2$ could be distinguished, the outcome deviated from a tetrasomic ratio of 1 : 4 : 1, largely because of a small $R_2R_2$ class. The other amphidiploid in this group, *G. thurberi* x *G. raimondii*, was tested with respect to one locus only, $R^{EAI}$ for petal spot, which showed a wide segregation ratio of 363 : 27. In group (3), the ratio for each of the four loci tested in 6*n* (*G. hirsutum* x Old World species) approximated 5 : 1. Nine loci belonging to six or seven different linkage groups were investigated in the hexaploid involving *G. raimondii*. Segregations for all the loci deviated in a highly significant manner from 5 : 1, ranging from 7·5 : 1 for *Cl* to 16·2 : 1 for *Gl*. The two loci analysed in 6*n* (*G. hirsutum* x *G. thurberi*), $L^s$ and $R_1$, had a mean segregation ratio of 31·9 : 1. Five loci ($Y_1$, $P_a$, $Lc_1$, *N* and $H_2$) in 6*n* (*G. hirsutum* x *G. raimondii*) failed to segregate, evidence thus being secured in support of the hypothesis of Stephens that the first four of these loci are situated in genome A. Segregation of $H_2$ in 6*n* (*G. hirsutum* x Old World species) offered additional evidence that this locus is in genome A. Data on segregation in the three types of interspecific combinations therefore reflect on the whole the relationship in the genus as established on morphological and cytotaxonomical grounds. Allopolyploids formed from close relatives yielded tetrasomic ratios, whereas allopolyploids between more distantly related sources gave wider ratios or were almost stable. Multivalent frequencies in 4*n* and 6*n* allopolyploids have been analysed in relation to segregation ratios by Sarvella [cf. XXVII, 4188] and are further discussed here. The authors examine in detail the validity of the following assumptions underlying the use of allopolyploid segregation as a quantitative criterion of taxonomic discrimination: (1) multivalent formation is random, (2) disjunction is also random, (3) no asynapsis or early desynapsis occurs, (4) elimination of gametes and zygotes does not have a selective influence on the characters under investigation and (5)

the alleles in question are stable. The problem of (6) chromatid segregation is also considered in this connexion. The general conclusion is reached that some loci did not completely fulfil the requirements of the above assumptions while others appeared to do so. Evolutionary aspects of allopolyploid segregation are discussed. The unexpected tetrasomic ratios obtained from 6*n* (*G. hirsutum* x Old World species) suggested that the A genomes have diverged little in homology and that therefore the A species are of relatively recent differentiation. It is however equally possible that *Gossypium* species may be highly stable as regards their chromosomes.

The authors have also extended their investigations to segregation in 6*n* allopolyploids of *Nicotiana tabacum*. They report some of the initial results for the loci *Yb* (burley) and *Yg* (yellow green) and briefly discuss them in relation to interspecific relationships. Ratios obtained from 6*x* (*N. tabacum* x *N. tomentosiformis*) suggested close homology of the related genomes and a much lower degree of homology in the case of 6*n* (*N. tabacum* x *N. otophora*). The allopolyploid with *N. sylvestris* gave a ratio of 12·4 : 1 for *Yb* and 29·4 : 1 for *Yg*. The combination with *N. glutinosa* segregated very little. No segregation was shown by 6*n* (*N. tabacum* x *N. glauca*) and 6*n* (*N. tabacum* x *N. knightiana*) for *Yb*. The ratio (24·5 : 1) obtained for *Yg* in the *N. glauca* allopolyploid was commensurate with that given for this locus by the *N. sylvestris* allopolyploid. The result was unexpected since the chromosomes of *N. tabacum* and *N. glauca* have a low affinity; possible reasons for this finding are briefly considered.

3364 *Srb, A. M. Some consequences of nuclear-cytoplasmic recombinations among various Neurosporas.* (*pp. 269–77*).

The mutant SG induced in *N. crassa* by acriflavine is characterized by slow germination of the ascospores and initially slow growth of the hyphae derived from the germinated ascospores. In repeated back crosses, the mutant property has consistently followed a maternal pattern of inheritance which has been unaffected by increasing substitution of the genome of *N. crassa*, with which SG was originally associated, by the genome of *N. sitophila*, *N. intermedia* and wild types of *Neurospora* from the Philippine Islands and Nigeria. In addition, the expressions of the same nuclear gene in different cytoplasms have provided evidence of the occurrence of plasmon disparities between evolutionarily divergent representatives of *Neurospora* [cf. 1106]. In one of the pertinent instances, *ac* (aconidial) in combination with *N. sitophila* cytoplasm produced the aconidial phenotype but in combination with the cytoplasm of *N. crassa* or SG *N. crassa* conditioned the wild phenotype with respect to conidia production. The other pertinent instance involved *S*, which in combination with *N. crassa* cytoplasm led to the formation of large colonies but in conjunction with cytoplasm of *Neurospora* from the Philippine Islands produced small colonies. Both possible instances of plasmon differences are regarded as closely paralleling some of the findings of Michaelis with *Epilobium*. Questions requiring further clarification in the work on *Neurospora* are indicated and the author points out that at this preliminary stage he has purposely avoided interpreting the results in term of plasmagenes or other physical models.

3365 *Nanney, D. L. Epigenetic factors affecting mating type expression in certain ciliates.* (*pp. 327–35*).

A discussion of systems regulating mating abilities in *Tetrahymena* and *Paramecium* is followed by a general analysis of the difficulties of distinguishing genetic and "epigenetic" systems. The chemical approach to the study of hereditary traits "substitutes a conceptual distinction for an operational distinction [based on the perpetuation of phenotypic differences in the same environment] and does not provide a reliable means for bringing observations into apposition with concepts. This problem is not alleviated by the lack of a correspondingly precise concept for control systems other than genetic systems; and these other systems, which may be called 'epigenetic systems', may mimic genetic systems in many ways." The concept of the genetic type of system may be based on the mode of perpetuation of information, i.e. the template replicating mechanism. "In any case no general and direct means now exists for demonstrating 'template replication' in a way which meaningfully relates it to cellular phenotypes. In spite of these difficulties, which should diminish with time, this concept appears to establish a new center about which genetic thought must be oriented." Epigenetic systems may be regarded as the integrative and "signal interpreting devices" regulating the expression of genetic potentialities and may be distinguished as such by failure to conform to the category of true genetic systems. Homeostasis, proof of the nuclear localization of the component of perpetuation, the degree of specificity with which heritable changes may be

induced by specific agents and the range of mutational alteration are evaluated as criteria in separating the two types of system.

3366 *Grant, V. The regulation of recombination in plants.* (*pp. 337–63*).

With reference to the literature on a wide range of genera of higher plants, a survey is given of factors which regulate recombination, viz. length of generation, chromosome number, frequency of crossing over, breeding system, mode of pollination, mode of seed dispersal, population size and various types of reproductive isolation.

3367 *Stebbins, G. L. Longevity, habitat, and release of genetic variability in the higher plants.* (*pp. 365–78*).

A study of Cichorieae has suggested the following course of evolution. The original members of the tribe were probably cross fertilizers, perennial, occupying stable habitats and in the possession of a relatively high basic chromosome number ($x = 9$). Evolutionary lines remaining in essentially the same habitats or entering other stable habitats retained cross fertilization and a high basic number, and sometimes evolved through polyploidy. Alteration of the genetic system in adaptation to greater reproductive efficiency with the consequent occupation of less stable habitats and greater fluctuations in population size entailed three methods of reducing recombination: (1) a trend towards self fertilization, (2) the development of apomixis and (3) reduction in the recombination index by reduction in chiasma frequency and presumably of cross-over frequency, increased asymmetry of the caryotype and reduction of the basic chromosome number. A close correlation exists between asymmetry of the caryotype and reduction in basic number, which appear to have been brought about by a sequence of pericentric inversions, unequal reciprocal translocations and loss of centromeres and adjoining heterochromatic regions. A similar course of evolution appears to have affected other members of the Compositae, and has probably occurred in many other families.

3368 *Brink, R. A. Paramutation at the* R *locus in maize.* (*pp. 379–91*).

With reference to published work and some unpublished data, the author surveys information gained on paramutation of $R^2$ (self-coloured aleurone), the term applied to the heritable changes and partial reversions the gene undergoes in certain heterozygotes. The following main features of the phenemenon have emerged. (1) The change of standard $R^2$ in heterozygotes with $R^{st}$ (stippled aleurone) and some other alleles occurs with 100% frequency, a fact not in accordance with the general principles that the properties of a daughter gene are determined exclusively by and in repetition of the parental component, and that alternative factors maintain their integrity in heterozygotes. (2) Paramutation of $R^2$ in $R^r$ $R^{st}$ plants is directed, since the alteration is always to a particular allele, $R^{r:st}$, possessing a weak effect in the production of pigment in the aleurone. Homogeneity of the change occurring in $R^2$ heterozygotes containing $R^{mb}$ (marbled aleurone) has not been established with certainty and the forms of $R^r$ derived from $R^r$ heterozygotes carrying certain mutations ($R^{sc}$) for self-coloured aleurone from $R^{st}$ are dissimilar. Further experimentation may possibly reveal that the alteration to $R^{r:st}$ is homogeneous only in the relative sense. (3) Only $R^r$ undergoes paramutation in $R^r$ $R^{st}$ heterozygotes and $R^{st}$ promotes such change without itself undergoing alteration. (4) The degree of alteration in the pigment-producing action of $R^r$ is on the average greater in $R^r$ $R^{st}$ than $R^r$ $R^{mb}$ plants. The effect on $R^r$ of certain self-coloured $R^{sc}$ mutations is conspicuously less than that of $R^{st}$. Thus paramutation is specific in that standard $R^r$ responds differently to three alleles. (5) All $R^r$ paramutants have been characterized by partial reversion, although little data have so far been obtained on the conditions promoting reversion and on the resulting forms of $R^r$. (6) Some, but not all, $R^{sc}$ mutations from $R^{st}$ cause paramutation of standard $R^r$. All $R^{sc}$ mutants have proved to be stable in heterozygotes with $R^{st}$. Certain $R^{sc}$ mutations, unlike the gene $R^{st}$ from which they originated, provoke paramutation in varying degrees in single $R^r$ $R^{sc}$ plants. Possibly $R^{st}$ is a compound allele, consisting of two components in a somewhat unstable relationship. One component may determine self-coloured aleurone while the other may inhibit pigment production and be essential for paramutation. Loss of the inhibitor from the locus, possibly by transposition, may be the basis of the spotted pattern characteristic of the action of $R^{st}$, as well as of the occasional mutations to self colour which are germinally recoverable. Slight but different displacements of the inhibitor from the locus along the same chromosome might cause paramutation at $R^r$ in the homologous chromosome but in different degrees, the disparities in the paramutagenic action of different $R^{sc}$ mutations being explicable on this basis. Transposition of the inhibitor to more distant

situations or its loss from the genome could result in loss of paramutagenic action at *R*, as may be the case for one $R^{sc}$ mutation. Instability of the transposed inhibitor with respect to either constitution or position could lead to variation in the paramutagenic effect of a given $R^{sc}$ mutation. Another possibility being explored is as follows. Self-coloured mutations from $R^{st}$ may involve crossing over at or close to the locus *R*, the paramutagenic component associated with the stippled condition being altered quantitatively or qualitatively in the process of exchange.

3369 *Emmerling, M. H. An analysis of intragenic and extragenic mutations of the plant colour component of the* $R^r$ *gene-complex in* Zea mays. (*pp. 393–407*).

As reported earlier [cf. XXIII, 2631], the $R^2$ region is regarded as consisting of two closely linked genes independent in action and mutation: (*P*) affecting plant colour and (*S*) seed colour, the former being the nearer to the centromere. Plant-colour mutations may be regarded as including locus *p* or, alternatively, as being deficient for this locus. By means of seed-colour mutants, the following crossing-over behaviour has been used as the basis of a critical test for distinguishing the two types of plant-colour mutations, viz. intragenic and extragenic. Since (*P*) and (*S*) are synaptically homologous, oblique crossing (referred to as unequal crossing-over in earlier papers by the author and his colleagues) may occur as the result of pairing between (*P*) of one segment and (*S*) of the homologous segment, or the converse synapsis. Thus pairing in the heterozygote (*p*) (*S*)/(*P*) (*S*) may be expected to yield two classes of cross-over type of seed mutants: distal and proximal pairing should respectively result in (*P*)$^{(8)}$ and (*p*) $^{(8)}$, $^{(8)}$ symbolizing deficiency at (*S*). The heterozygote $^{(p)}$(*S*)/(*P*) (*S*), on the other hand, may be expected to give cross overs showing only distil displacement [(*P*)$^{(8)}$], since absence of (*p*) would prevent proximately displaced pairing. Fourteen plant-colour mutants derived from the stock (*P*) (*S*): Cornell were studied by means of data on the cross-over and non-cross-over types of seed mutants that they produced, as indicated by the behaviour of markers of the (*P*) (*S*) region in test crosses of heterozygotes for the various plant-colour mutations and for (*P*) (*S*) : Cornell as females with (*p*) (*s*)/(*p*) (*s*) plants. Of the four plant-colour mutants which, in their origin, were not associated with crossing over of markers and were therefore suspected to be intragenic, only one may have been of this type. No decision could however be made concerning its origin, since the parental stock was not appropriately marked. The mutant arose from the heterozygote *G* (*P*)(*S*) *K*/*g* (*p*)(*s*) *k*, and could be interpreted as the result of either mutation to (*p*) in the *G* (*P*)(*S*) *K* chromosome or double crossing over of the regular type. The other three non-cross-over mutants, as well as the remaining ten, which were associated in their origin with crossing over of markers, proved to be extragenic. In addition, about 50% of the seed-colour mutants were also due to extragenic alterations. Reasons are given for believing that further experimentation may reveal that seed-colour mutants not associated in their origin with crossing over and on this evidence regarded as intragenic are in fact extragenic. Transposition, intrachromosomal crossing over, spontaneous deficiency and sister-strand crossing over are discussed as possible explanations of the unexpected finding that three of the non-crossover plant-colour mutants were extragenic. Finally, the occasional (*p*) $^{(8)}$ cross over from plants heterozygous for $^{(p)}$ (*S*) are interpreted on the basis of spontaneous deficiencies at both (P) and (*S*), and mention is made of the difference found with respect to the frequency of oblique crossing over between non-cross-over and cross-over plant-colour mutants originating from the same cross. In non-cross-over mutants the rate of such crossing over was $0{\cdot}7 \times 10^{-4}$ whereas in cross-over mutants it was $1{\cdot}4\text{–}3{\cdot}0 \times 10^{-4}$. No explanation of this difference other than the presence of modifiers is at present possible.

3370 *Mangelsdorf, P. C. The mutagenic effect of hybridizing maize and teosinte.* (*pp. 409–21*).

Hybrids from crosses of the maize inbred Texas 4R–3 with four varieties of teosinte were back crossed three times with 4R–3, selection being made in favour of plants exhibiting certain characteristics of teosinte, chiefly those of the cob. Since 4R–3 proved unsuitable for the purpose of the investigation, the homozygous back-cross material was crossed with another inbred, Minn. A158, and a second cycle of back crossing effected. All the teosinte varieties were alike in the effect of chromosome 4 upon characteristics of the rachis and glumes. Both 4R–3 and A158 are stable strains, but in their modified derivatives spontaneous mutation occurred in at least 3·6% of the plants grown during 1950–54. Mutations were found with respect to (1) the gametophyte, disturbances in Mendelian ratios thus being produced, (2) the

endosperm, (3) chlorophyll characters, (4) dwarfs and (5) male sterility. Mutations associated with translocations were also detected. The mutations affected a limited number of loci, the same mutations occurring repeatedly. Some were quite stable, having a fairly constant expression in different genetic backgrounds and segregated more or less normally in outcrosses with unrelated stocks. Others were quite unstable in expression, even in a uniform genetic background, and failed to segregate in outcrosses with certain stocks. Stable mutations arose in the chromosome which had been introduced from teosinte or in its maize homologue, tended to be associated with heterozygosity of the chromosome pair in question, and did not differ in type according to the teosinte donor variety. Unequal crossing-over is suggested as the most satisfactory explanation of the origin of stable mutations in heterozygous stocks. Unstable mutations sometimes appeared in strains highly homozygous and in some cases affected loci in chromosomes other than the one introduced from teosinte. Defective endosperm (*de*$^{t5}$), a dwarf type and three mutations affecting the ♂ gametophyte are described as examples of the unstable category. The first-mentioned has been the most extensively studied; its locus is probably on the short arm of chromosome 9. Different patterns were found in the variation in the frequency distributions with respect to the weight of kernels resulting from selfing of the *de*$^{t5}$ mutant. It is possible to regard these patterns as corresponding to states of the locus, as in the case of the expression of unstable loci studied by McClintock [cf. XXIII, 5]. The dwarf type was inherited as a simple recessive but, like *de*$^{t5}$, the mutation was highly variable in expression. Three factors affecting pollen-tube development have been identified, two being on chromosome 4 and the third on chromosome 9. Each of these factors was variable in expression and usually conferred a disadvantage upon the gametophytes carrying it. Analysis of the linkage relationship of *de*$^{t5}$ with *C* for aleurone colour on chromosome 9 provided a clue to the nature of the unstable mutants. In classifying defective seeds for aleurone colour, it was noted that the cross overs, i.e. defective kernels with coloured aleurone, were often better developed than defective seeds with colourless aleurone. The fact that crossing over influenced degree of endosperm development suggested that a polygene segment was involved which, when homozygous, has an inhibitory effect on endosperm development. It is postulated that the different states of *de*$^{t5}$ may be interpreted as manifestations of different degrees of teosinte introgression by a polygene segment into chromosome 9, and that the instability of the states may be assumed to be the result of crossing over, an event which either increased or decreased the length of the polygene segment. This hypothesis is used to interpret certain patterns in frequency distributions of kernel weight in terms of overlapping polygene segments.

The extent of teosinte introgression into maize is considered. Prehistoric specimens of cobs suspected of being maize x teosinte hybrids have without exception closely resembled cob specimens from derivatives of maize x teosinte obtained experimentally. Chromosomes having effects similar to those of teosinte chromosomes may be extracted from existing varieties of maize. A number of hybrids from crosses with Latin American varieties bore prominent lignified glumes similar to those attributable to teosinte introgression. When these hybrids were crossed with inbred A158, modified strains of A158 were obtained with ears virtually indistinguishable from those of strains modified by the direct introduction of teosinte chromosomes. Spontaneous mutations have occurred with A158 strains modified with extracted chromosomes from maize varieties. Some of the mutations were identical with those found in A158 strains resulting from direct introgression by teosinte. The transposibility of teosinte genes is discussed. They may be regarded as transposible on the assumption that interchange may take place between homologous regions of incompletely nonhomologous chromosomes of maize and teosinte. Finally, the author suggests that some of the mutations arising in highly inbred lines of maize may be due to transposition of polygene segments originally derived from teosinte.

3371 Demerec, M.
**Albert Francis Blakeslee.**
Genetics 1959 : **44** : 1–4.

A brief account is presented of the career of Blakeslee whose many activities included cytogenetic studies of fungi and higher plants and in particular of *Datura*.

3372 Woodward, D. O.
**Enzyme complementation *in vitro* between adenylsuccinaseless mutants of *Neurospora crassa*.**
Proc. nat. Acad. Sci. USA 1959 : **45** : 846–50.

By mixing mycelial homogenates from pairs of complementing adenylsuccinaseless mutants [cf.

XXVII, 3669], each member of which had been grown separately, adenylsuccinase activity as high as 20% of that in *in vivo* complementation in heterocaryons was obtained. Mixtures of extracts from noncomplementing mutants failed to restore enzyme activity. If the homogenates from the complementing mutants were not mixed immediately after the mycelia had been disrupted, enzyme activity was not detected. Further investigation of *in vivo* restoration of enzyme activity confirmed the earlier finding of a correlation between map distance separating complementing mutants and amount of adenylsuccinase activity [cf. 2195]. *In vivo* complementation resulted in the restoration of enzyme activity to a maximum level not exceeding 25% of that of the wild type. The results supported the hypothesis previously suggested that complementation "involves a cytoplasmic exchange mechanism operating at either the RNA or polypeptide level".

3373 Boiteau, P
**(Dialectical-materialist concept of heredity).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 11–17. [Russian].

This article, which has been translated from the French, reviews recent British, American and French research on genetics of plants, animals and microorganisms. The topics discussed include vegetative hybridization, the nature of heterosis, transformation, the biochemical and biophysical properties of DNA and depolymerization. The writer rejects the view of some geneticists that DNA functions in the same way as the gene is believed to do by the adherents of the chromosome theory.

3374 Lederberg, J.
**Genes and antibodies.**
Science 1959 : **129** : 1649–53.

The author formulates an elective theory of antibody production on the basis of microbial genetics. According to the elective approach, the information required to synthesize a given antibody is already inherent in the organism before the antigenic stimulus is received.

3375 Krieg, D. R.
**A study of gene action in ultraviolet-irradiated bacteriophage T4.**
Virology 1959 : **8** : 80–98.

"The action of individual $r_{II}^+$ genes of bacteriophage T4 was analysed by crosses between ultraviolet-sterilized wild-type phage and unirradiated phage mutant for the gene being investigated. Inactivation of a gene (i.e., loss of its capacity for phenotypic action) was characterized by a single-hit relation to dose, with a sensitivity of 0·10 and 0·05 per phage-lethal damage for A and B cistrons, respectively. The presence of an $r_{II}^+$ gene in the progeny of a cross was also studied. This phenomenon, called cross reactivation (CR), involves genetic duplication and recombination of irradiated phage. In some experiments doubly mutant phage was used for simultaneous analysis of two genes. The interpretation of these experiments is based on the assumption that cistrons (genes, or, more precisely, genetic units of function) occupy certain lengths along the phage linkage structure ('chromosome'). A radiation-induced damage on this chromosome will inactivate a phage, but a phage's undamaged components may act in a mixed infection. A damage located anywhere within a cistron destroys its capacity for phenotypic action. Undamaged specific genetic elements may be rescued by CR. 'Survival of phenotype' (SP) is not normally a prerequisite for CR; in these experiments, however, survival of the phenotype of the particular $r_{II}^+$ gene being investigated was a necessary (but not sufficient) condition for CR.

"The experiments are discussed with regard to the role of phage genes in initiating infection and with regard to radiation genetics, with particular attention to cross reactivation and multiplicity reactivation of bacteriophage."
[Author's summary].

3376 Fisher, R. A.
**An algebraically exact examination of junction formation and transmission in parent-offspring inbreeding.**
Heredity 1959 : **13** : 179–86.

Further to the theory of junctions elaborated by the author in two earlier publications [XX, p. 831 and XXV, 35], exact algebraic expressions are found for the proportion of germinal strands expected to be heterogenic and for the expected number of junctions in alternate parent-offspring mating. Homogeneity, as Bennett discovered [XXIV, 777], is attained more rapidly in this type of inbreeding than by sib mating but the difference is found to be rather less (1·6–1·8 generations) than Bennett supposed.

3377 Mitchell, M. B.
**Genetic recombination in Neurospora.**
Genetics 1958 : **43** : 799–813.

Some observations which are not in agreement with the usual assumptions made in studying the genetic behaviour of nutritional mutants of

*Neurospora* are reported and discussed. Recurrence of certain frequencies of recombination between mutants assumed to be linked has been observed in classifying and counting random ascospores about 12 hours after germination. The more commonly recurring frequencies of prototrophs were between 0·5 and 3% and around 7 and 8%. The same frequencies have also often appeared as deviations from the expected frequency of 25 or 50% in crosses of supposedly unlinked mutants or in crosses between mutants and wild types. In several map regions, analysis of mutants regarded as closely linked failed to offer convincing evidence of a linear order of the markers. The results of back-cross tests carried out to classify mutant segregates as single or double mutants have suggested that this distinction is without meaning unless applied to specific crosses, since the same mutant may give the result expected from a double mutant in one cross but behave as a single mutant in another. In crosses of nutritional mutants, modified or new requirements may arise as a result of recombination. It is tentatively suggested that apparent discrepancies in the phenotypic expressions of mutant characters may be regarded as reflections of differences in dosages of certain chromosomes, in a manner analogous to the determination of sex in *Drosophila*. The recurrence of certain frequencies of prototrophs suggests the possible existence of several patterns of nuclear behaviour which lead to the formation of viable spores. A more precise analysis, both genetical and cytological, of fertile crosses may reveal the nature of some of these patterns. With regard to the growth responses, it appears likely that relationships between mutants having different requirements as well as between those having similar requirements have been misunderstood, partly because of the limitations of the growth tests ordinarily made. Perhaps a thorough analysis, attaching as much significance to modifiers as to primary characters, may be revealed in this connexion also. Cases in which reversals of nutritional mutants in vegetative culture have been difficult to demonstrate in out crosses to standard wild strains or in back crosses may possibly be more satisfactorily interpreted on the basis of somatic segregation than of reversed mutation.

3378 Bartlett, G. W. & Hinshelwood, C.
**Observations on the drug resistance of bacterial recombinants.**
Proc. roy. Soc. : Ser. B : 1959 : **150** : 318–35.

Strains of *Escherichia coli* 'K12', sensitive or resistant to chloramphenicol, proflavine or brilliant green, were crossed in combinations of the types sensitive x resistant, resistant x sensitive and resistant x resistant. The parents had complementary biochemical requirements, selection being made for prototrophic recombinants on a minimal medium. The drug resistance of the recombinants was determined according to a quantitative scale of "units of resistance", based on the values of the drug concentrations at which the lags in growth caused by the drug attained a chosen standard value. In crosses of (1) Y–40 ($F^+$) as the parent sensitive to chloramphenicol or proflavine with Y–53 ($F^-$) as the resistant parent and (2) 58–161 ($F^+$) as the parent sensitive to brilliant green with W–677 ($F^-$) as the resistant parent, the average number of resistance units recovered in the recombinants was about equal to the average parental resistance. When the position was reversed as to the parental resistance, i.e. when Y–40 or 58–161 constituted the trained parent, the average of resistant units was much lower than the average parental resistance. In resistant x resistant combinations, the latter relationship also held but to a much less pronounced extent. In general, the recombinants showed a continuous spectrum of degrees of resistance, with a greater probability of values in the middle of the range between the parental values. Although recombinants were frequently obtained which approached the more resistant parent in number of resistance units, none were found carrying an appreciably higher degree of resistance. In a cross between Y–40 and Y–53, respectively trained with respect to resistance to proflavine and chloramphenicol, no cross resistance was detected. The interpretation of the results is discussed in general terms. Data on the average recovery of parental resistance in the recombinants are regarded as being in conformity with the donor-receptor hypothesis of recombination. A resistant donor strain could only distribute part of its units of resistance to daughter colonies, whereas with a resistant receptor the likelihood of recovering resistance would be greater. The specific parts of the cell corresponding to the units of resistance appear to undergo nonrandom interchange during recombination. It is however suggested that the selection of recombinants on a minimal medium may have weighted an essentially random system against too exclusive a contribution from one parent. The acquired drug resistance in the strains studied is heritable in the sense that it is able to persist for a good many generations in the absence of the drug.

The view is expressed that, although the hypothesis of the transfer of linearly arranged genes or permanent sites of action from the donor to the receptor by means of a chromosome segment is formally consistent with the results, there remains the question as to how far the biochemical effect produced in the cells by the drug is to be entirely accounted for by changes in DNA.

3379 Olive, L. S.
**Aberrant tetrads in *Sordaria fimicola.***
Proc. nat. Acad. Sci. USA 1959 : **45** : 727–32.

An analysis of 23 asci showing aberrant segregation for ascospore colour indicates that some process other than crossing over, back mutation or irregularities in nuclear survival was responsible. It is suggested that the aberrant ratios may be attributed to transreplication, whereby a locus is copied more than the normal number of times during replication at meiotic prophase. The occurrence of some asci with a 5 : 3 ratio for wild-type and mutant spores lent support to the hypothesis that each chromatid is composed of two functional subunits.

3380 Saito, H.
**Heterocaryosis and genetic recombination in *Streptomyces griseoflavus.***
Canad. J. Microbiol. 1958 : **4** : 571–80.

"Upon prolonged incubation of two auxotrophic mutants from *Streptomyces griseoflavus* 142 plated together on minimal medium, heterocaryotic colonies producing only parental type conidia were formed. In addition, from the mixed culture of two double auxotrophs on a medium supplemented with limited amounts of nutrients, stable recombinant-type conidia were recovered at relatively high frequencies. According to these observations, it is suggested that genetic recombination occurs in heterocaryotic mycelial growth antecedent to conidiation. However, complete synapsis appears to be doubtful because of the unbalanced patterns of recombinant recovery."
[Author's summary].

3381 Miyake, T. & Demerec, M.
***Salmonella-Escherichia* hybrids.**
Nature, Lond. 1959 : **183** : p. 1586.

The results so far obtained with hybrids between *S. typhimurium* 'LT–7' carrying a mutator gene (*mut*) and *E. coli* strains characterized by a high frequency of recombination (Hfr) may be summarized as follows. (1) Hybrids combining genetic markers carried separately by the two parents have been produced. (2) Among these hybrids three types were distinguished: (*a*) sensitive to virulent *Salmonella* phage H5 but resistant to *E. coli* phage T6, and agglutinated by *Salmonella* serum; (*b*) resistant to H5 and T6, with very slight or no agglutination by *Salmonella* serum; and (*c*) resistant to H5 but sensitive to T6, and undergoing no agglutination by *Salmonella* serum. (3) Temperate *Salmonella* phage grown on type (*a*) is capable of transducing markers carried in the *Salmonella* part of the chromosomal complex, provided the recipient *Salmonella* bacteria carry *mut*. (4) This temperate phage forms about $10^1$–$10^2$ times more plaques on (*a*) than on LT–7 *mut* and $10^2$–$10^4$ times more plaques than on LT–7 without *mut*. No difference was found between hybrid LT–7 *mut* and LT–7 *mut*$^+$ with regard to phage adsorption. (5) The order of certain loci in the *Salmonella* genome as determined from data on the hybrids was: *mut - thr - leu - pan - prs - lac*. The data further indicated that *prs* and *lac* are in close proximity and also close to *asa*, *glt* and *arg*.

3382 Hershey, A. D., Burgi, E. & Streisinger, G.
**Genetic recombination between phages in the presence of chloramphenicol.**
Virology 1958 : **6** : 287–88.

The results of experiments with mutants r4 and r7 of phage T2H showed that phage particles formed after ultraviolet irradiation and chloramphenicol treatment contain chromosomes that are often recombinant in structure. This finding is discussed in relation to Tomizawa's results [cf. 3457]. It seems probable that the recombinations occurred during the period of chloramphenicol treatment.

3383 Bodmer, W. F. & Parsons, P. A.
**The analogy between factorial experimentation and balanced multipoint linkage tests.**
Heredity 1959 : **13** : 145–56.

It is possible to treat *n*-point back-cross linkage tests as $2^n$ factorial experiments in which the treatments correspond to genotypes, the main effects to the main viability effects of the genes, the interactions between main effects to viability interactions and the blocks to modes of gamete formation. It is then possible to measure the major sources of variation by an analysis of $\chi^2$. Small deviations from orthogonality should not result in serious error. The method is illustrated by analyses of two published sets of 3-point linkage tests.

3384 Bodmer, W. F.
**Multiplicative effects and the logarithmic transformation in the analysis of balanced multi-point linkage tests.**
Heredity 1959 : **13** : 157–64.

The analysis reported in the preceding abstract presupposes additive effects. By using the logarithmic transformation, which would turn multiplicative into additive effects, and repeating the analysis, it is possible to ascertain whether the two presuppositions as to type of interaction entail similar or dissimilar results in the analysis of $\chi^2$. This approach is illustrated by analysis of a hypothetical 2-point experiment and a published 3-point experiment.

3385 Binet, F. E., Clark, A. M., & Clifford H. T.
**Correlation due to linkage in certain wild plants.**
Genetics 1959 : **44** : 5–13.

"A hypothetical, monoecious population is postulated in which a fixed proportion of the male and female gametes produced by every zygote unite at random with those of the opposite kind produced by the same zygote, while the remainder partake in panmictic union.

"Formulae are given by which the genotype frequencies in a given generation can be expressed in terms of those in an arbitrary earlier generation.

"A discussion of the model leads to the brief consideration of some factors that might operate to maintain an excess of either coupled or repulsed phases. If these factors operate with sufficient intensity, then linkage can persistently contribute to correlation, even under panmixia."
[Authors' summary].

3386 Frost, L. C.
**The genetics of some wild-type and mutant strains of *Neurospora crassa*.**
Abstr. Diss. Univ. Camb. 1957 : 15–16.

"The cytogenetics of the wild-type strains is reviewed. Heterogeneity is present in the centromere distance of mating-type in certain crosses involving mixed Abbott and Lindegren, as opposed to pure Lindegren, wild-type ancestry. Crosses of similar wild-type ancestries result in heterogeneity in centromere distances of loci distributed in essentially all the linkage groups. Probably the Abbott wild-types are genetically different from each other and from the Lindegren wild-types. Segregation of the factors controlling heterogeneity in centromere distances is demonstrated. A possible genetic mechanism to account for these phenomena is advanced. Heterogeneity is also present in recombination data from crosses involving more than one wild-type in other fungi. Repeated backcrossing to a standard wild-type to minimize these disturbing factors is advocated". The occurrence of pseudowild types among three albino-I mutants and linkage data for some arginine mutants are reported. The taxonomy of the forms is revised, a limitation to two species, *N. sitophila* and *N. tetrasperma*, being proposed, since *N. sitophila* and *N. crassa* are connected by intermediate forms. It is further suggested that standard genotype should be substituted for the term wild type, the Lindegren wild types should be adopted as the standard genotype of *N. crassa* and the pseudowild types should be termed pseudorecombinants.

3387 Rifaat, O. M.
**Genetical studies on the mating-type chromosome of *Neurospora crassa*.**
Abstr. Diss. Univ. Camb. 1956–57 (1959) : 24–25. (Abst.).

The effect of temperature on the frequency of recombination was investigated. In one experiment, involving four markers fairly close to the centromere, two on each arm of the chromosome, the chief effect of change of temperature was on crossing over in the immediate neighbourhood of the centromere. Frequencies of crossing over in this region increased significantly at 30° C. and decreased significantly at 17° C., compared with those at the optimum temperature for division, 25° C. These results are interpreted as indicating variation in the length of the differential distance between the centromere and mean position of the first cross over. Reversal in the order of the loci *mt* (mating type) and *arg*–3, probably due to inversion, is reported [cf. XXVIII, 3660]. Using strains lacking the putative inversion, data were obtained suggesting that the cross-over frequency in the centromeric region of each arm of the chromosome carrying *mt* is controlled by at least two genes with equal and additive effect and that the genes affecting the one arm act independently of those influencing the other. Different stocks are dissimilar with respect to these genes, which segregate during inbreeding by sib mating and cause considerable variability in recombination values and centromere distances. An analysis was also made of strand relationships and chromatid and chiasma interference both within arms and across the centromere of the *mt* chromosome. The results confirm the work of

Lindegren in indicating a marked excess of two-strand double cross-overs across the centromere.

3388 Wilson, J. Y.
**Temperature effect of chiasma frequency in the bluebell *Endymion nonscriptus*.**
Chromosoma 1959 : **10** : 337–54.

A constant but gradual decrease in mean chiasma frequency with increasing temperature was observed in material known to be homogeneous for chiasma frequency; at each temperature just enough time for meiosis to be completed was used [cf. 2174]. A decrease in mean chiasma frequency was associated with an increase in internuclear variance.

3389 Edgar, R. S. & Steinberg, C. M.
**On the origin of high negative interference over short segments of the genetic structure of bacteriophage T4.**
Virology 1958 : **6** : 115–28.

High negative interference has been observed in biparental crosses involving three closely linked *r*II markers. Recombination values were measured in crosses in which the relative frequencies of the two parents were varied and an analysis of the data indicated that the negative interference is due primarily to correlated exchanges arising as a result of a single mating event. In triparental crosses, smaller negative interference occurred; as with the biparental cross, the negative interference was only demonstrable between closely linked markers.

3390 Carlson, E. A.
**Comparative genetics of complex loci.**
Quart. Rev. Biol. 1959 : **34** : 33–67.

This review compares the genetics of pseudoallelic loci in *Drosophila*, maize, cotton, viruses, bacteria, fungi and a number of other organisms, and discusses the theories advanced to interpret such loci.

3391 Serra, J. A.
**Statistical nature of the gene.**
Portug. acta biol. : Sér. A. : 1958 : **5** : 210–12.

The view that, in higher species, the behaviour of the gene, like that of other physicochemical systems, reflects the average motion of statistically large populations of molecules is put forward. "In higher species the statistical nature of the genes is assured by the number of genons [cf. 64]. Changes of these elementary units are gradual owing to homeostatic buffering." Violent changes in entire nemameres, such as may be brought about by mutagens, correspond to few alternatives at the gross mutation level. The behaviour of the gene is thus alternative with respect to gross mutation and statistical with respect to fine differences and gradual mutation.

3392 Serra, J. A.
**Types of mutations.**
Portug. acta biol. : Sér. A. : 1958 : **5** : 206–09.

On the basis of the theory of the structure of genetic units proposed in earlier papers [63–64], the author envisages two main types of mutation. The first, termed potential mutation, comprises changes at the molecular or genon level which are not phenogenetically apparent, while the second, termed effective mutation, comprises changes occurring at the nemamere level and resulting in phenogenetic alterations. At the nemamere level, the simplest type of change is from activation to inactivation or the reverse, causing different levels of production of a biologically active substance such as an enzyme. At the genon level, mutation is more gradual, becoming effective, as distinct from potential, above a certain threshold number of changed groups or sites. Gross allelic mutations caused by radiation and other mutagenic treatments are likely to be of the nemamere type, while smaller mutations, corresponding to fine differences between eualleles, may be brought about by the summation of metabolically induced alterations in molecular groups and genons. While gross gene mutations depend on alterations in nemamere structure within a gene, true position effects of the mimic type are regarded as resulting from alterations extending over several genes, especially when heterochromatin is involved.

3393 Six, E.
**The rate of spontaneous lysis of lysogenic bacteria.**
Virology 1959 : **7** : 328–46.

"A new method is described for measuring the rate of spontaneous lysis and the generation time of lysogenic cells while growing on agar plates. With this method a study was made of several lysogenic strains, derivatives of *Escherichia coli C* and of *Shigella dysenteriae Sh*, carrying one, two, or three prophages (*P*2 or variant *P*2 *Hy dis*). No influence of the genetic markers of the *P*2 prophages employed or of the different immunity classes (*P*2 vs. *P*2 *Hy dis*) was found. The results suggest that the rate of

spontaneous lysis is affected by the genetic conditions of the host : host type (*C* or *Sh*) and location of the prophage on the genetic chromosome of the bacterium (for strain *C*). The presence of an unrelated prophage (*P*1) does not affect the rate at which cells produce *P*2 by spontaneous lysis. The rate of spontaneous lysis is not proportional to the number of *P*2 prophages per nucleus. This is explained as an effect of immunity-specific interactions between homo-immune prophages, while location effects may play a lesser role.

"Accidental fluctuations in the generation time permitted an analysis of the variation of the rate of spontaneous lysis as a function of the generation time. For any given strain, the results are consistent with the notion of a constant rate of spontaneous lysis per 'physical' unit of time, independent of the generation time."

[Author's summary].

3394 Uetake, H.
**The genetic control of inducibility in lysogenic bacteria.**
Virology 1959 : **7** : 253–62.

"From the inducible lysogenic strain A($\epsilon^{15}$) of *Salmonella* two noninducible derivatives were isolated. One was a defective-lysogenic strain; the other was not defective but carried a mutant prophage $\epsilon^{15}b$. In both cases the noninducibility proved to be due to a change in the host cell, not in the prophage itself. Most defective-lysogenic derivatives of A($\epsilon^{15}$) were still inducible." [Author's summary].

3395 Morse, M. L.
**Transduction by staphylococcal bacteriophage.**
Proc. nat. Acad. Sci. USA 1959 : **45** : 722–27.

About one phage particle in $10^7$–$10^8$ transduced the genes for resistance to streptomycin or novobiocin.

3396 Bertani, G. & Six, E.
**Inheritance of prophage P2 in bacterial crosses.**
Virology 1958 : **6** : 357–81.

"Prophage P2 may be located on the genetic chromosome of the host cell (*Escherichia coli* strain C) by crossing genetically marked lysogenic strains. At lysogenization, prophage P2 establishes itself at a specific locus (location I or preferred location). In the process of double lysogenization by means of superinfection of a single lysogenic strain, the second prophage establishes itself at a different locus. Two such second-choice locations are recognized. In superinfection of doubly lysogenic strains, substitution of the prophage in location I occurs more often than substitution of the prophage in the second-choice location. A temperate phage closely related to P2, but belonging to a different immunity class, behaves like P2 in respect to location choice.

"In doubly lysogenic strains the prophage in the preferred location contributes more heavily than the other prophages to the phage yield of the lysogenic cells."

[Authors' summary].

3397 Symonds, N. & McCloy, E. W.
**The irradiation of phage-infected bacteria : its bearing on the relationship between functional and genetic radiation damage.**
Virology 1958 : **6** : 649–68.

Measurements were made of the sensitivity to different kinds of irradiation of bacteria singly infected with phages during the first five minutes of the latent period. Ultraviolet radiation with and without photoreactivation, soft X rays and $P^{32}$ decay were used. In only one case was an increase in radiation resistance found during this period, i.e. when T2-infected bacteria were subjected to ultraviolet irradiation and their resistance measured before photoreactivation had been carried out. This result can be explained by distinguishing between functional radiation damage which inhibits an essential biochemical step in phage synthesis and genetic radiation damage involving the inhibition of replication. It is thought that photoreactivable damage is wholly functional whilst the damage by ionizing radiations and the nonphotoreactivable damage caused by ultraviolet radiation are both functional and genetic.

3398 Epstein, R. H.
**A study of multiplicity reactivation in the bacteriophage T4. 1. Genetic and functional analysis of T4D-K12 (λ) complexes.**
Virology 1958 : **6** : 382–404.

It was found that restitution of a complete genetic structure occurs in the mating of parental structures and it appears that no multiplication of genetic structures occurs prior to the formation of this genome. There is also evidence that damages caused by ultraviolet irradiation stimulate recombination in neighbouring parts of the genome. Some ultraviolet-induced damage affecting critical viral functions was found to be localized in the genetic structure of the phage; the damage also affected other unspecified functions not necessarily required for reactivation of the genome. These two effects

appeared to form a relatively large proportion of the sensitive target in multiplicity reactivation.

3399 Fox, M. S.
**Phenotypic expression of a genetic property introduced by deoxyribonucleate.**
J. gen. Physiol. 1959 : **42** : 737–48.

An analysis was made of the kinetics of the appearance of cells showing streptomycin resistance in a population of streptomycin-sensitive pneumococci after treatment with DNA isolated from a resistant strain. The results led to the conclusion that the phenotypic manifestation of the genetic action of the incorporated DNA occurred abruptly, the individual transformed cell passing from a condition of typical streptomycin sensitivity to one of relative streptomycin indifference in less than 3 minutes. The time at which this transition occurred was randomized with respect to a mean time of 60 minutes after DNA incorporation.

3400 Cohen, D.
**A variant of phage P2 originating in *Escherichia coli*, strain B.**
Virology 1959 : **7** : 112–26.

"A dismune derivative of phage P2 (able to impart a different specificity of immunity to superinfection when present as prophage in a lysogenic cell) is shown to originate through hybridization between P2 and some genetic element of *Escherichia coli* strain B and is therefore symbolized as P2 *Hy dis*. The hypothesis according to which the element involved is a previously unrecognized prophage is supported by the following facts: strain B is immune to infection by P2 *Hy dis*; this property may be lost as a consequence of infection with P2; the ability to originate dismune phage is lost at the same time as the immunity to superinfection by it. Unfortunately it has not been possible to demonstrate any, even defective, phage particles corresponding to the postulated prophage." [Author's summary].

3401 Pakuła, R., Hulanicka, E. & Walczak, W.
**Sensitivity to ultraviolet irradiation of the streptomycin-resistance activity in transforming DNA of different bacteria.**
Bull. Acad. polon. Sci. : Sér. Sci. Biol. 1959 : **7** : 217–22.

The streptomycin resistance of transforming DNA extracted from different bacteria varied in stability towards ultraviolet irradiation according to the source of DNA, the marker in the DNA of the streptococcal strain Challis sr being about 1000 times less sensitive than that of *Haemophilus influenzae* 'Rds.' The ultraviolet sensitivity was greater in intraspecific than in interspecific transformation.

3402 Mandel, S. P. H.
**Stable equilibrium at a sex-linked locus.**
Nature, Lond. 1959 : **183** : 1347–48.

It is shown that, for two sex-linked alleles, $A,B$, assuming that the female sex is homogametic, the conditions determining stable equilibrium are identical with those governing two autosomal alleles $A,B$, when $a' = aa^*$, $h' = \frac{h(a^* + b^*)}{2}$ and $b' = bb^*$, where $a$, $h$, $b$, are the respective relative viabilities of female $AA$, $AB$ and $BB$, $a^*$, $b^*$ are the respective relative viabilities of male $A$ and $B$, and $a'$, $h'$, $b'$ are the respective relative viabilities in the autosomal situation.

Then, if $V^e$ is the mean viability of female zygotes at equilibrium, the conditions for stable equilibrium are given by $V^e > a' = aa^*$, $V^e > b' = bb^*$.

3403 Ogur, M., St. John, R. & Ogur, S.
**Direct experimental observation of cells in phenomic lag.**
Science 1959 : **129** : 1612–13.

By using yeast cells with a very high spontaneous rate of cytoplasmic mutation to respiration deficiency and a grid plate containing a medium totally selective against the mutant cells, direct microscopic observation was made of mutants of recent origin passing through a limited number of phenomic lag divisions.

3404 Suskind, S. R. & Jordan, E.
**Enzymatic activity of a genetically altered tryptophan synthetase in *Neurospora crassa*.**
Science 1959 : **129** : 1614–15.

The td mutants of *N. crassa* are unable to form tryptophane from indole and serine. Partially purified preparations of the $td_2$ mutant which contains, like certain other td mutants, a protein (CRM) antigenically related to wild-type tryptophane synthetase, proved to be capable of converting indole + triose phosphate to indole glycerol phosphate. The capacity to synthesize indole glycerol phosphate was inhibited by anti-CRM sera. It is suggested that CRM in td mutants represents a damaged tryptophane synthetase lacking the capacity to react with serine. Possibly the action of specific suppressor mutations capable of partially restoring tryptophane synthetase activity involves conversion of a CRM protein to active tryptophane

synthetase by reactivating a catalytic site on the CRM protein. The presence of a protein immunologically related to tryptophane synthetase has also been reported in tryptophane-requiring mutants of *Escherichia coli* [cf. 1192].

3405 Suhov, K. S.
**(The problem of hereditary variation of pathogenic viruses).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 117–37. [Russian].
[Cf. XXVIII, 2513].

3406 Freese, E.
**The difference between spontaneous and base-analogue induced mutations of phage T4.**
Proc. nat. Acad. Sci. USA 1959 : **45** : 622–33.
Mutants for the rII region induced by 2-aminopurine (AP) and 5-bromodeoxyuridine (BD) could also be made to revert by either of these analogues. The reversion index (average ratio of reversals to viable phages assayed on bacteria B for stocks grown from an inoculum of 100 phages) varied according to the mutant and base analogue. Mutants induced by proflavine and most spontaneous mutants, with respect to the rII region, could not however be induced to revert by AP or BD, although they underwent spontaneous reversion. The data lead to the conclusion that most rII-type mutants revert by back mutation to the standard genotype. Two fundamentally different types of mutagenic action are therefore revealed: (1) one by which the base analogues induce forward mutations and their reversions, and (2) another responsible for the formation and reversion of those mutants which could not be made to revert by the base analogues. It is possible to arrive at a simple molecular explanation of (1) and (2) by assuming that each new chain of replicating DNA is formed along a preexisting complementary chain according, for example, to the model proposed by Watson and Crick, and that all the mutations in question were due to errors in DNA replication. Thus, mutagenic action of the first kind is attributed to mistakes in base pairing when, or after, a base analogue is incorporated into DNA. Whatever the exact process, a purine would always be replaced by another purine and a pyrimidine by another pyrimidine. The second type is interpreted on the basis of transversion, a purine being replaced by a pyrimidine and vice versa. Both types of mutation would involve only one nucleotide pair. This hypothesis of two mutually exclusive mutagenic effects leads to the following verifiable conclusions. All agents converting one purine of DNA into another purine or one pyrimidine into another pyrimidine can only induce mutations of the first kind. Such mutations can be induced to revert by the same or, sometimes more efficiently, by another agent belonging to this class. Incorporation of a base analogue into DNA should not increase the frequency of transversion since apparently no base analogue would make the necessary errors in pairing more often than any of the normal bases. Certain errors in pairing responsible for (2) may however be increased by the following: (*a*) a large unbalance of the nucleotide ratio at the direct DNA precursor level, e.g. by thymine starvation, (*b*) agents which separate the hydrogen bonds of DNA or which otherwise tend to pull or keep the DNA chains apart, and (*c*) agents which attach to one nucleotide in DNA and one noncomplementary nucleotide in the medium and provide a suitable bridge between their sugar-phosphates to permit incorporation. Types (1) and (2) of mutagenic action should be found in other organisms. The results are important with respect to the coding of proteins by DNA.

3407 Röbbelen, G.
15 Jahre Mutationsauslösung durch Chemikalien. **(15 years of mutation induction by chemicals).**
Züchter 1959 : **29** : 92–95.
A survey is presented of some of the more important research done in this field during the last 15 years.

3408 D'Amato, F.
Mutations chromosomiques induites par des substances mutagènes. **(Chromosome mutations induced by mutagenic substances).**
Scientia, Bologna 1958 : **52** : 1–10.
This survey begins with a brief account of mitotic and meiotic processes and includes descriptions of different types of chromosome mutation and their mode of formation. The results obtained since the discovery in 1943 of the mutagenic action of some chemicals are reviewed and a list is provided of some of the principal mutagens known; these include simple elements such as bromine and oxygen and complex organic compounds. Many metabolites of living organisms have been found to have a mutagenic action when present in certain concentrations in the cells; thus spontaneous mutations seem to have a physiological origin [cf. XXVI, p. 696]. Differences between the mutagenic action of chemicals and ionizing

radiations are noted; the chemical mutagens induce quite different radiation spectra. It seems to be possible to modify the effects of chemical mutagens by various physical and chemical treatments.

3409 Röbbelen, G.
Instabile Genmanifestation nach Röntgenbestrahlung von *Arabidopsis thaliana* (L.) Heynh. [**Unstable gene expression after X irradiation of *A. thaliana* (L.) Heynh.**].
Z. Naturf. 1958 : **13b** : 14–16.

The expressivity of an X-ray induced recessive *chlorina* factor decreased from a maximum value in the $F_2$ to a lower constant value in the $F_7$. Crosses of the early-generation hybrids with normal mother plants increased the rapidity with which the expressivity declined, but the reciprocal crosses did not have this effect. Cultivation at low temperatures inhibited the decrease. It is suggested that the hereditary material itself was not altered by irradiation but that gene-dependent physiological processes were affected.

3410 Kimball, R. F., Gaither, N. & Wilson, S. M.
**Reduction of mutation by post irradiation treatment after ultraviolet and various kinds of ionizing radiations.**
Radiation Res. 1959 : **10** : 490–97.

"Post irradiation exposure to streptomycin reduces the amount of recessive lethal and deleterious mutation produced in *Paramecium aurelia* by X-rays in the absence of oxygen as well as in its presence, by α-particles and by ultraviolet light. Thus the reversible step that is influenced by the post treatment is common to the mutational processes induced by all these radiations, making it probable that this step is more closely related to the structure and activities of the chromosomes than to the nature of the initial physical events in them. Certain peculiarities of the ultraviolet dose curves lead to the suggestion that this radiation acts not only as a mutagen but also as a recovery agent through its effects on growth and division". [Authors' summary].

L'atome et l'agriculture. VII. Les perspectives de l'utilisation agronomique de l'action génétique des radiations. (**The atom and agriculture. VII. The prospects of agronomic utilization of the genetic action of radiations**).
Agric. prat. 1958 : **122** : 488–90.

This is a general and popular article on the use of radiation-induced mutation in plant breeding.

3412 Matsumura, S.
(**The application of irradiation in breeding**).
Nogyo oyobi Engei/Agric. & Hort. 1957: **32** : 662–63. [Japanese].

A short review is given of recent work on the induction of mutations in plants by means of X or γ irradiation.

3413 Kaudewitz, F., Vielmetter, W. & Friedrich-Freksa, H.
Mutagene Wirkung des Zerfalles von radioaktivem Phosphor nach Einbau in Zellen von *Escherichia coli*. (**Mutagenic effect of the decay of radioactive phosphorus after incorporation in cells of *E. coli***).
Z. Naturf. 1958 : **13b** : 793–802.

The decay of $P^{32}$ incorporated into cells of *E. coli* 'B/r' induced inactivation during storage in liquid nitrogen at — 196° C. and an increase in mutation to auxotrophy which was linear with respect to the degree of inactivation and to the fraction of $P^{32}$ decayed. At a survival rate of $10^{-4}$, 0·67% of the surviving cells gave rise to auxotrophic colonies, of which 40–50% had prototrophic sectors.

3414 Matsuo, K.
(**Studies on the use of radiation-induced mutation in plant breeding**).
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 423–26, 563–66, 705–08, 857–60, 1003–06, 1137–40, 1281–86. [Japanese].

An extensive review is given of recent, principally American, work on the induction of mutations and chromosome aberrations by irradiation and of theories that have been developed to explain the qualitative and quantitative effects obtained.

3415 Szybalski, W. & Pitzurra, M.
**Mechanism of chemical mutagenesis. III. Induced mutations in spheroplasts of *Escherichia coli*.**
J. Bact. 1959 : **77** : 621–22.

It was found that frequencies of both spontaneous mutations and mutations induced by $MnCl_2$ or triethylene melamine (TEM) in normal bacillary forms of *E. coli* suspended in saline solution were not significantly different from the corresponding values obtained for spheroplasts of *E. coli* suspended in the same medium, the spheroplasts having been obtained by treatment with LiCl. In 20% sucrose solution, $MnCl_2$ and TEM had no mutagenic effect on normal bacilli or spheroplasts.

3416 Lück, H. & Rickerl, E.
Lebensmittel-Zusatzstoffe und mutagene Wirkung. V. Mitteilung: Untersuchungen über die Erzeugung einer Streptomycinresistenz bei *Escherichia coli* durch Benzoesäure und p-Oxybenzoesäureäthylester. (**Food additives and mutagenic effect. V. Investigations on the induction of streptomycin resistance in *E. coli* by means of benzoic acid and ethyl p-oxybenzoate**).
Zbl. Bakt. 1959 : **112** : 226–34.

A 0·01 M benzoic acid solution increased the rate of mutation to streptomycin resistance in *E. coli* from the normal value of $10^{-8}$–$10^{-9}$ to $10^{-6}$–$10^{-7}$ at a pH below 3·8. For ethyl p-oxybenzoate the rates were $10^{-6}$ at pH 7 and $10^{-4}$–$10^{-5}$ at pH 4·7. At temperature of 56° C. and a pH of 2·7 each had a similar mutagenic effect.

3417 Brenner, S. & Smith, J. D.
**Induction of mutations in the deoxyribonucleic acid of phage T2 synthesized in the presence of chloramphenicol.**
Virology 1959 : **8** : 124–25.

Experiments are described indicating that the phage DNA synthesized in the presence of chloramphenicol is sensitive to the mutagenic action of bromouracil; this synthesis is thought to represent the replication of the genetic material of the virus.

3418 Litman, R. M. & Pardee, A. B.
**Mutations of bacteriophage T2 induced by bromouracil in the presence of chloramphenicol.**
Virology 1959 : **8** : 125–27.

An experiment is described showing that infected bacteria making phage DNA in the presence of chloramphenicol are sensitive to the mutagenic action of a bromouracil compound. This supports other evidence that this DNA is identical with the genetic material of the phage. The mutagenic action of bromouracil is thought to result from its incorporation into DNA, the mutation being an alteration in the base sequence.

3419 Kubitschek, H. E., & Bendigkeit, H. E.
**Delay in the appearance of caffeine-induced T5 resistance in *Escherichia coli*.**
Genetics 1958 : **43** : 647–61.

"When caffeine is added to the medium of a continuous culture (chemostat) of *Escherichia coli*, strain B/1,t, the mean delay period for the appearance of bacteria resistant to the phage T5 is 3·42 ± 0·10 generation times of the parent culture. No difference in delay is observed for several caffeine concentrations, bacterial concentrations, growth rates at two temperatures, and for the appearance of two mutant strains of T5-resistant bacteria, designated E and L, and differing in their growth rates in the presence of large concentrations of T5. These results indicate that the use of the chemostat has eliminated a selection artifact commonly observed when phage is sprayed upon cultures of agar.

"In addition, for the case (these experiments) where the mutant culture has the same growth rate as the parent culture, it is shown mathematically that the mean delay period is measured by the time given by the intersection of two straight lines fitted to the data."

[Authors' summary].

3420 Vielmetter, W. & Wieder, C. M.
Mutagene und inaktivierende Wirkung salpetriger Säure auf freie Partikel des Phagen T2. (**Mutagenic and inactivating effect of nitrous acid on free particles of phage T2**).
Z. Naturf. 1959 : **14b** : 312–17.

Inactivation of the phage and an increase in the plaque-type mutants m, tu and r were induced by treatment with nitrous acid at pH 4·5, the rate of inactivation following first-order kinetics and the number of r mutants showing a linear increase with duration of treatment. At a survival rate of $10^{-4}$, 3% of the surviving particles give rise to r plaques. About 30% of the plaques were mottled, segregating to give about 50% unstable $r^-$ and 50% stable r with 0·05–0·1% mottled, while the nonmottled mutants remained stable through subsequent passages. The inactivation and mutagenic effects were shown to be due only to the nitrous acid, and an increase of mutants by positive selection during inactivation was experimentally excluded.

3421 Doudney, C. O. & Haas, F. L.
**Mutation induction and macromolecular synthesis in bacteria.**
Proc. Nat. Acad. Sci. USA 1959 : **45** : 709–22.

Making use of reverse mutants to tryptophane independence, further experiments were carried out on *Escherichia coli* to elucidate the nature of postirradiation processes involved in the induction of mutation by ultraviolet radiation (UV) [cf. XXVIII, 1169 and 3709]. The results reported in the present and earlier papers have led to the following conclusions

and suggestions. (1) The mutagenic nucleic-acid precursors are probably UV-modified RNA pyrimidines. (2) The process of "mutation stabilization" (MS) [for definition of this and subsequent terms cf. XXVIII, 3709] requires a complex source of aminoacids which must be supplied immediately after UV treatment in a relatively high concentration. MS may entail the specific association of aminoacid-nucleotide monomers with the DNA double helix, as proposed by Stent [cf. XXVIII, 3572], and thus the "mutation frequency decline" (MED) may be associated with enzymatic conversion of these precursors into metabolites not utilizable in templating. (3) The high correlation between RNA synthesis and "mutation fixation" (MF) in UV-exposed cultures lends support to the view that mutation is fixed through RNA synthesis. Further corroboration of this view is provided by correlation between values for MF as determined by lack of response to the reversing effect of chloramphenicol or light, and by correlation between the MFD caused by 5-hydroxyuridine with RNA synthesis since this analogue could be incorporated so as to form nonfunctional RNA. The significance of the finding that the maximum value of MF was attained at the time at which the cellular RNA had doubled in amount remains to be elucidated. (4) Possibly RNA synthesis is intermediate to DNA synthesis, RNA (and possibly protein) mediating the transfer of information from parent to daughter genetic RNA. (5) It is further postulated that mutation may consist of a change in composition of a single nucleotide-pair unit in the daughter DNA. The one gene to one enzyme hypothesis may thus have the corollary of one nucleotide pair unit to one aminoacid, in so far as the mutational modification of genetic and enzymatic specificities is in question. The involvement of ribonucleoprotein as an intermediate in DNA replication would provide not only a fortuitous mechanism for gene action in the formation of specific enzymes.

3422 Stadler, J., & Yanofsky, C.
**Studies on a series of tryptophan-independent strains derived from a tryptophan-requiring mutant of *Escherichia coli*.**
Genetics 1959 : **44** : 105–23.

Tryptophane-independent phenotypic revertants arose from a tryptophane-requiring mutant ($td_2$) of *E. coli* strain K–12 both spontaneously and after ultraviolet irradiation. These phenotypic revertants included both suppressed mutants and true revertants; relatively more suppressed mutants were produced after ultraviolet treatment. Suppressed mutants were characteristically slow growers but true revertants had various growth rates which in some cases approached the level of the wild type, partial reversion having occurred. It was found that tryptophane-synthetase activity had been restored to some extent in both suppressed mutants and partial revertants but enzyme activity did not appear to be correlated with growth rate. It is suggested that, in partial reversion, the back mutation restores the ability to form tryptophane synthetase but the enzyme may not be qualitatively the same as the wild-type enzyme. Since many distinguishable partial revertants were recovered from a single mutant, it seems unlikely that all the reversions occurred at the exact site of the original mutation.

3423 Popescou, C. T.
Sur un hybride de greffe entre un églantier (*Rosa canina*) et le rosier Maréchal Niel. [**On a graft hybrid between a dog rose (*R. canina*) and the rose Maréchal Niel**].
CR Acad. Sci., Paris 1959 : **248** : 2631–33.

Bud grafting of Maréchal Niel [Marshal Niel] on to *R. canina* was effected in 1928. In 1952, two root suckers from just below the stem of the stock, about 2 m. below the point of grafting, on being allowed to develop, became sarmentose like Maréchal Niel and in 1958 produced fine deep red flowers with a scent distinct from that of the cultivated variety.

3424 Jinks, J. L.
**Selection for adaptability to new environments in *Aspergillus glaucus*.**
J. gen. Microbiol. 1959 : **20** : 223–36.

As indicated by differences in the percentage survival and mean lag period shown by inocula when transferred from a normal medium to one containing a poison such as mercuric chloride or unfamiliar sugar sources, colonies of *A. glaucus* arising from single asexual spores or the hyphal tips of the same or different homocaryon clones frequently varied in their adaptability to new environments. The differences between homocaryon clones in adaptability to the new media were characteristically nuclear in origin, while those between colonies of the same clone were characteristically cytoplasmic. The nuclear system exerted, however, a strong influence on

the cytoplasmic system involved in adaptability and is described as "epistatic" to the latter. Selection for cytoplasmic differences resulted in marked changes in the adaptability of the asexual spores of single colonies, even though the technique used was such that colonies in the direct line of selected descent were at no time exposed to the new media. Alterations in adaptability to mercuric chloride were not correlated with rate of growth on a normal medium. Correlation between growth rate and adaptability to sugars was fairly high. The change in adaptability to mercuric chloride and those in adaptability to sugars were therefore independent. It is concluded that evidence has been obtained of two or possibly three cytoplasmic systems with much the same properties of variation but independent in action and transmission.

3425 Thornley, M. J. & Yudkin, J.
**The origin of bacterial resistance to proflavine. 1. Training and reversion in *Escherichia coli*.**
J. gen. Microbiol. 1959 : **20** : 355–64.
The preliminary experiments described in the first of this series of papers provided no evidence in support of Hinshelwood's model of specifically induced adaptation.

3426 Thornley, M. J. & Yudkin, J.
**The origin of bacterial resistance to proflavine. 2. Spontaneous mutation to proflavine resistance in *Escherichia coli*.**
J. gen. Microbiol. 1959 : **20** : 365–72.
Proflavine resistance was found to arise through a series of spontaneous mutational steps in the absence of contact wtih proflavine.

3427 Sinai, J. & Yudkin, J.
**The origin of bacterial resistance to proflavine. 3. The alleged rapid adaptation to proflavine resistance in *Bacterium lactis aerogenes* (syn. *Aerobacter aerogenes*, *Klebsiella pneumoniae*).**
J. gen. Microbiol. 1959 : **20** : 373–83.
No evidence was obtained of rapid adaptation of *B. lactis* var. *aerogenes* or *E. coli* to proflavine by direct induction. It is concluded that growth in cultures to which the drug is added gradually, as reported for the former species by Baskett [cf. XXIII, 111] in apparent support of the Hinshelwood model, is chiefly due to a decrease in the inhibitory action of the drug by the acid formed during growth in a glucose + salts medium.

3428 Sinai, J. & Yudkin, J.
**The origin of bacterial resistance to proflavine. 4. Cycles of resistance in *Escherichia coli* and their bearing on variations in resistance in cultures.**
J. gen Microbiol. 1959 : **20** : 384–99.
A relatively small and reversible increase in resistance, attributed to phenotypic adaptation, was detected when small amounts of proflavine were added at 30 min. intervals to growing unsynchronized cultures. It is suggested that the cyclic variation in phenotypic adaptability to proflavine during the division cycle, as found in partially synchronized cultures, may explain the continuous range of resistance shown by an ordinary sensitive culture, comprising bacteria at all stages of the division cycle. Such cyclic variation may also explain the effect of additions of proflavine in raising the resistance of a high proportion of the bacteria in a growing unsynchronized culture, those bacteria at the adaptable stage continuing to grow and divide. The authors do not however rule out the possibility of clonal variation in adaptability due to asymmetrical division. Such variation would be continuous and superimposed on the variable phenotypic adaptation in the division cycle. The degree of phenotypic variation may be governed by the genotype; possibly the first-step mutant showing resistance and succeeding mutants may have certain ranges of phenotypic variability so that a continuous range of resistance may occur, bridging the intervals between the levels representing inherent genotypic resistance, from the most sensitive bacterium to the most highly resistant.

3429 Sinai, J. & Yudkin, J.
**The origin of bacterial resistance to proflavine. 5. Transformation of proflavine resistance in *Escherichia coli*.**
J. gen. Microbiol. 1959 : **20** : 400–13.
The demonstration of transformation of proflavine-sensitive strains to resistance by growth in the presence of DNA extracts from resistant mutants is reported. It is suggested that under certain conditions transformation may provide an additional chance of survival to the bacterial population.

3430 Cabezas de Herrera Sánchez, E.
Infección de diferentes géneros de leguminosas con una estirpe de *Rhizobium* procedente de *Lupinus angustifolius*. II. (**Infection of different leguminous genera with a *Rhizobium* strain from *L. angustifolius*. II.**)
An. Edafol. Fisiol. veg. 1958 : **17** : 669–78.

Cabezas de Herrera Sánchez, E.
Infección de diferentes géneros de leguminosas con una estirpe de *Rhizobium* procedente de *Pisum sativum*. III. (**Infection of different leguminous genera with a *Rhizobium* strain from *P. sativum*. III.**)
Ibid. 1958 : **17** : 755–64.

*Rhizobium* strain 5 isolated from *L. angustifolius* and strain 6 from *P. sativum*, when inoculated separately into a number of different leguminous species, produced only very few nodules. After repeated culture on an artificial medium, however, each induced a high rate of nodulation in each species. After reisolation from its respective host plant, each strain corresponded more closely in its nutritional requirements with the strain specific for that species. [Cf. 2217].

3431 Foltýn, J.
Genetika i genetika. (**Genetics and genetics**).
Za socialist. Zeměd. 1957 : **7** : 1525–28.

The writer distinguishes between Mendelian and Lysenko genetics, of which only the latter is accepted by him. Most of the article deals with a paper by Hrubý which is criticized for its Mendelian position.

3432 Pazourková, Z. & Pokorný, V.
O dvojí genetice. (**About two kinds of genetics**).
Biológia, Bratislava 1958 : **13** : 394–97.

The content of the above paper by Foltýn [3431] is criticized as unfounded on facts. It is claimed that Lysenko's theories have checked the progress of genetics in the USSR for a period of 9 years. It is pointed out Lysenko has been criticized by Baranov, Sukačev, Dubinin and Turbin in Russia and also by the Polish geneticist W. Gajewski.

3433 (**Ten years since the August session of the Lenin Academy of Agricultural Sciences**).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 7 : 3–6. [Russian].

[Cf. 1212].

3434 Prezent, I. I.
(**The contribution of I. V. Mičurin to the theory of the development of living nature in the postrevolutionary period of his activity**).
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 76–98. [Russian].

From extensive citations of Mičurin's writings it is shown that in the postrevolutionary period he began to emphasize the value of employing parents from widely distant geographical areas and the importance of training the seedlings; the view that Mendel's laws do not apply to crosses of fruit trees and that most mutations are either adaptations or segregations also belongs to this period. It is submitted that the term "gene" as used by Mičurin has nothing in common with the genes of the geneticists.

3435 (**The erroneous standpoints of the *Botanical Journal* and its future work**).
Bot Ž. (Bot. J.), Moskva 1959 : **44** : i–vi.

In this editorial note the editorial board of the *Botaničeskij Žurnal* [*Botanical Journal*] admits that the journal has unjustly criticized some representatives of Mičurinist science, particularly T. D. Lysenko. The errors to which exception is taken are: the recognition of the random nature of the changes that lead to evolution; the denial of the creative role of selection and the inheritance of acquired characters; the suggestion that the material used in the so-called conversions was genetically heterogeneous; the rejection of the directed conversion of winter into spring cereals and of vegetative hybrids; the interpretation of plant growth substances as special stimulators of vital processes; the accusation of financial losses incurred by application of Lysenko's principles; the recognition of Dobzhansky and other supporters of eugenics, which is the basis of modern race prejudice; and the suggestion that Lysenko rejects the principle of hybrid corn.

Mention is made of Mičurinist principles presented by speakers from Switzerland, Japan, England and elsewhere at the 10th International Genetics Congress and of the interest shown in the session on vegetative hybridization at the Congress. It is claimed that the belief in the inheritance of acquired characters is gaining ground in western countries and the new editorial board will conduct the journal on strictly Mičurinist lines. Agencies such as ionizing radiation, colchicine and radioisotopes are to be applied exclusively on the principles of

materialistic biology and not from the standpoints of corpuscular genetics. Special attention is to be given in future to questions having a direct bearing on practical problems in agriculture, industry and medicine.

3436 **(For strengthening the connexion between biology and practice).**
Vestn. Akad. Nauk SSSR (Rep. Acad. Sci. USSR) 1959 : No. 3 : 3–7. [Russian].

This article urges practical utilization of the results of biological research and criticizes the *Botaničeskij Žurnal* for failing to do so and for contesting some Mičurinist tenets and discrediting research by Lysenko and his adherents.

3437 **(The appointment of members of the editorial board of the *Botaničeskij Žurnal*).**
Vestn. Akad. Nauk SSSR (Rep. Acad. Sci. USSR) 1959 : No. 3 : p. 112. [Russian].

Changes in the editorial staff of the above journal are announced because of official disapproval of its previous policies. V. F. Kuprevič, the new editor, and his colleagues have been set the task of improving the journal by promoting materialist biology. [Cf. 3436].

3438 **(Awards to scientists).**
Vestn. Akad. Nauk SSSR (Rep. Acad. Sci. USSR) 1959 : No. 3 : p. 115. [Russian].

On the occasion of his sixtieth birthday T. D. Lysenko has been awarded the Order of Lenin for "great services to agricultural science and practical help to industry".

3439 **(Agrobiological science and the false views of the "Botanical Journal").**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 3–8. [Russian].

The article in *Pravda* for 14 Dec. 1958 [cf. 1213] is reproduced.

3440 Pavlov, T. D.
**(An offensive or a retreat along the whole theoretical and practical front in Mičurinist biology).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 3–10. [Russian].

This article, which has been translated from Bulgarian, discusses in general terms Mičurin-Lysenko and formal genetics and expresses the author's unqualified support for the former. The writer refers to the chromosome theory as "idealist, agnostic and mystical" and disputes the existence of genes. In this connexion he mentions a photograph of a gene shown to him at the agrobiological Institute at Hadmersleben. This is described as merely "a thickening of a portion of one chromosome" and is explained by physiological and other external conditions.

3441 Quintanilha, A.
**Social implications of Mendelism versus Michurinism.**
Nature, Lond. 1959 : **183** : 1222–24.

The author argues that the rejection of the Darwinian theory of the struggle for existence as an evolutionary factor by the Mičurinists is the consequence of their conviction of incompatibility between this theory and the socialist ideal of a classless society based on the principle of cooperation.

3442 Gluščenko, I. E.
**(The phenomenon of multiple fertilization in plants).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 98–116. [Russian].

[Cf. XXVIII, 2451].

## EVOLUTION

3443 Croizat, L.
**An essay on the biogeographic thinking of J. C. Willis.**
Atti Ist. bot. Univ. Pavia 1958 : **15** : 229–55.

In this critique of the evolutionary views of Willis, the author agrees with Willis's criticisms of the usual Darwinian conception of speciation and his implied acceptance of orthogenetic tendencies. The persistence of the cyathium of *Euphorbia* is quoted as an example of a phenomenon inexplicable in terms of natural selection. However, the author dissociates himself from the constructive hypotheses which Willis introduced as alternatives to Darwinian notions, and in particular from the Age and Area hypothesis.

3444 Ross, R.
**Thoughts on the major classification of the organic world.**
Proc. Linn. Soc. Lond. 1959 : **170** : 98–99. (Abst.).

The author draws attention to the following facts. (1) Except in the purple sulphur bacteria, the photosynthetic process throughout the organic world is based on chlorophyll a and is generally similar. (2) All nucleate organisms are fundamentally alike in nuclear structure and cell division, differences being only minor. (3) As revealed by recent electron-microscope research, the structure of the flagellum and cilium is remarkably uniform, irrespective of the type of organisms in which they occur. These similarities suggest that each of the three attributes is monophyletic. Their present

distribution further suggests that they arose in the order given. Possible paths of evolution of the main groups of organisms are postulated on the basis of this view. It is pointed out that a classification embodying this view would bring about the disappearance of the traditional division into the plant and animal kingdoms.

3445 Hendrych, R.
Poznámky k problému vznikání a vývoje druhu u vyšších rostlin. (**Remarks on the problem of the origin and evolution of species in higher plants**).
Act. Univ. carol., Prag. 1954 : Pp. 118.

In this essay Darwin's views on the origin of species are analysed and he is criticized for failing to appreciate the importance of the environment in evolution and for denying the occurrence of revolutionary changes in organisms. It is stated that evolution does not depend on interspecific and intraspecific relationships but results from a conflict within organisms between heritability and variability which arises from the interaction of organism and environment.

The struggle for existence is considered and then the views of Lysenko are critically examined and compared with those of Mičurin, Komarov and others. The present author does not agree with all of Lysenko's views; for example Lysenko is thought to be wrong in denying that transitional forms arise in nature. Instances of alleged transformations of species described in the literature are also examined and in many cases a true transformation is considered to be unproved. Then the possible development of species through successive changes is discussed; this process and hybridization are thought to have played some part in the origin of species.

3446 Tahtadjean [Tahtadžjan], A. L.
Adaptare directă sau selecție naturală? (Despre legile statistice în biologie). [**Direct adaptation or natural selection? (On statistical laws in biology)**].
An. Romîno-Soviet. : Ser. Biol. 1957 : No. 4 : 44–59.

[Cf. XXVIII, 1180].

3447 **Homeostatic mechanisms.**
Brookhaven Symposia in Biology 1957 : No. 10 : Pp. 270.
*Rapoport, A. Stochastic, mechanical, and teleological views of homeostasis.* (*pp. 243–53*).

The author gives a philosophical discussion of the above views in connexion with the study of homeostatic processes in biology, with some reference to evolution and with arguments in favour of a "quasi-teleological" approach.

3448 Berg, R. L.
**A general evolutionary principle underlying the origin of developmental homeostasis.**
Amer. Nat. 1959 : **93** : No. 869 : 103–05.

[Cf. XXVIII, 3779].

3449 Blagoveščenskij, A. V.
(**Biochemistry of protein substances and plant evolution**).
Bjull. Glavnogo Bot. Sada (Bull. Princ. Bot. Gdn.), Moskva-Leningrad 1958 : No. 31 : 45–49. [Russian].

Differences in the prolamines and globulins in different cereal grains and in the proportions of vicilin and legumin in the seeds of leguminous species presumed to be of different phylogenetic ages are mentioned in illustration of biochemical differences that may have evolutionary significance. The gliadin of *Agropyron glaucum* has been shown to differ in composition from that of perennial wheat M2 and the wheat Lutescens 329. The view is expressed that the phylogenetically younger taxa have "smaller, more mobile, more active protein molecules" and that their enzymes have "a greater capacity to reduce the energy of activation of the reactions they catalyse". The older phyla are saved from extinction, it is suggested, by arochemosis, a process whereby "the processes of metabolism are raised to a higher plane of energy", thus giving the organism a greater capacity to withstand extreme conditions of environment and hence to evolve.

3450 Cain, A. J.
**Deductive and inductive methods in post-Linnaean taxonomy.**
Proc. Linn. Soc. Lond. 1959 : **170** : 185–217.

"The purpose of this paper is to set out the taxonomic theories of the French school using Cuvier's highly influential works as the material for examination, to show in what way they were unsatisfactory and how far they were amended by Darwin, to discuss the validity of Darwin's own theory of taxonomy, and finally to indicate what *a priori* basis is at present usable by evolutionary taxonomists."

3451 Lysenko, T. D.
(**On the biological species and the origin of species**).
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 5–34. [Russian].

This is a reprint of an article published in 1956 [cf. XXVII, 2495].

## CYTOLOGY

3452 Poleakov [Poljakov], I. M., Dmitrieva, A. N., & Zdrilko [Zdril'ko], A. F.
**Date noi despre folosirea izotopilor radioactivi in studiul fecundării la plante. (New data on the use of radioactive isotopes in studying fertilization in plants).**
An. Romîno-Soviet. : Ser. Biol. : 1957 : No. 3 : 41–56.
[Cf. XXVII, 2541].

3453 Pastýrik, L'.
Akademik Bohumil Němec 85 ročný. **(Academician Bohumil Němec is 85 years old).**
Biológia, Bratislava 1958 : **13** : 162–65.
This biography, written on the occasion of the 85th birthday of this Czechoslovak botanist, refers to his studies of the cell nucleus, polyploidy, and plant reproduction.

3454 Martin, F. W.
**Staining and observing pollen tubes in the style by means of fluorescence.**
Stain Tech. 1959 : **34** : 125–28.
It was found that pollen tubes in the styles of the tomato and other flowering plants could be observed by using the following technique. "Styles are fixed in formalin-acetic-80% alcohol (1 : 1 : 8) and cleared and softened in a strong (±8N) sodium hydroxide solution. Staining is accomplished in a 0·1% solution of water-soluble aniline blue dye dissolved in 0·1N $K_3PO_4$. The styles are smeared or are observed whole under a conventional or dissecting microscope by direct illumination with ultraviolet light of a wavelength of about 356 mμ. Observations are made in a darkened room. Under these conditions callose fluoresces bright yellow-green and contrasts strongly with the bluish or greyish fluorescence of the stylar tissue. The pollen tubes are outlined by a callose lining and irregularly spaced callose plugs".

3455 MacEwan, A. M.
**Preparation of whole mounts of embryosacs of plants.**
Stain Tech. 1959 : **34** : p. 157.
A method based on a procedure described by Marvin and Matzke has been developed for preparing stained whole mounts of embryo sacs and gymnosperm female gametophytes. A minimum amount of the tissue is fixed, stained and embedded in paraffin; the tissue is then soaked in cuprammonia for several hours. Then the embryo sac is dissected out, dehydrated with alcohol and cleared.

3456 Zalokar, M.
**Nuclear origin of ribonucleic acid.**
Nature, Lond. 1959 : **183** : p. 1330.
Autoradiographic investigation of the centrifuged contents of hyphae of *Neurospora crassa* demonstrated that RNA was formed only in the nuclei and passed subsequently into the cytoplasm. This finding suggests that RNA is a direct product of gene action.

3457 Tomizawa, J.
**Sensitivity of phage precursor nucleic acid, synthesized in the presence of chloramphenicol, to ultraviolet irradiation.**
Virology 1958 : **6** : 55–80.
"Infected bacteria, in which phage precursor nucleic acid (DNA) has been allowed to accumulate in the presence of chloramphenicol, can be irradiated with multiple phage-lethal doses of ultraviolet light (UV) without preventing formation of phage particles after subsequent removal of chloramphenicol. Considerable numbers of such particles prove to be noninfective. With a small dose of UV, phage particles and deoxyribonucleic acid (DNA) are produced more or less normally after resumption of protein synthesis, but more than half of the particles lack infectivity. The number of noninfective particles produced is roughly proportional to the amount of precursor DNA present at the time of irradiation. Irradiation of bacteria before infection does not cause the production of noninfective particles. Large doses of irradiation permit synthesis of protein and maturation of phage particles with little concomitant DNA synthesis, after removal of chloramphenicol. About 99% of the particles produced under these conditions are noninfective. With such preparations, photoreactivation, cross reactivation and multiplicity reactivation can be demonstrated with an efficiency appropriate to the dose of UV actually used.
"These results mean that phage precursor DNA formed in the presence of chloramphenicol presents a characteristic UV-sensitive target equivalent in all respects to that contained in finished phage particles. Since this target is presumed to be the phage chromosome, its formation in the presence of chloramphenicol seems to show that multiplying phage chromosomes are composed of DNA to the exclusion of all other known phage constituents. Irradiation of such chromosomes under the conditions described produces persistent lesions which do

not prevent the subsequent formation of normal chromosomes; the lesions themselves are neither repaired nor replicated.

"Other experiments show that DNA synthesized at different times is incorporated into single phage particles and therefore that the phage precursor DNA destined for a given particle does not consist of a unitary structure finished in advance. Moreover both irradiated and unirradiated DNA is found in both live and dead particles after maturation. Preliminary analysis of the manner of mixing shows that the bulk of the phage precursor DNA, like that of parental origin, consists of roughly equal parts of DNA that is (in a formal sense) resistant or sensitive, respectively to UV damage."

[Author's summary].

3458 La Cour, L. F. & Pelc, S. R.
**Effect of colchicine on the utilization of thymidine labelled with tritium during chromosomal reproduction.**
Nature, Lond. 1959 : **183** : 1455–56.

Experiments on the incorporation of thymidine labelled with tritium in the DNA of chromosomes of growing root meristems of *Vicia faba* have given evidence that colchicine influences either the synthesis of the acid or its subsequent distribution among sister chromatids at metaphase. In one experiment, in which colchicine was not used, chromosomes with both sister chromatids labelled were found regularly at metaphase and anaphase 24 hr. after labelling, and frequently also 48 hr. after labelling. In a second experiment, cochicine was used in the following way. Seedlings were raised in tap water containing 0·05% colchicine to which labelled thymidine was added 1 hr. later. After 8 hr. the solution was replaced by fresh tap water + 0·05% colchicine and roots were fixed after 20 and 24 hr. Autoradiographs of both samples showed some chromosomes labelled in only one chromatid already in the first mitosis after labelling. Closely similar results have since been obtained with colchicine concentrations ranging from 0·025 to 0·1%, treatment commencing 2 and 4 hr. before the application of labelled thymidine. These findings are discussed in relation to those of Taylor *et al.* [XXVII, 2508], Taylor [1237] and Woods and Schairer [2237]. The authors question the statistical significance of the analysis by Woods and Schairer and answer the criticism that they neglected to take into consideration the adsorption of $\beta$ particles in chromatids separated from the film by a layer of cytoplasm or other organic material.

3459 Gopal-Ayengar, A. R.
**Cytochemical studies of nuclear metabolism in biological systems.**
Proc. 2nd UN internat. Conf. peaceful uses atomic Energy, Geneva 1958 : **25** : 108–10.

Experiments on the incorporation of thymidine labelled with $C^{14}$ or $H^3$ into chromosomes in the lateral meristems of *Vicia faba*, *Haplopappus* and *Allium* have shown that chromosomal replication is not always associated with equipartition of the parental DNA, as would be expected on the basis of the Watson-Crick model and the results of Taylor *et al.* [cf. XXVII, 2508], but that nearly 30% of the chromosomes showed irregular distribution of DNA [cf. XXVII, 1128]. Unpublished work by La Cour and Pelc is quoted in which the nuclei in the regions of elongation and differentation in *V. faba* showed a higher labelling with tritiated thymidine than those of meristematic cells. This did not occur with adenine labelled with $P^{32}$ or $C^{14}$ and it is thought that the incorporation of thymidine into DNA may occur independently of cell division or polyploidy in differentiated cells. It is suggested that another mode of chromosome synthesis than that proposed by Taylor may operate.

3460 Warden, J. W.
Contribución para el estudio cariológico de los híbridos en Kalanchoideae, I. (**Contribution to the caryological study of hybrids in the Kalanchoideae. I**).
Portug. acta biol. : Sér. A. : 1958 : **5** : 185–205.

Chromosome numbers have been investigated in various *Bryophyllum* species and hybrids. It is noted that hybrid clones from *B. calycinum* ($2n = 34 + 4$) x *B. daigremontianum* ($2n = 34$) were characterized by the presence of tumours and by intraindividual variation in chromosome number; some of these irregularities appeared to result from variation in the four accessory chromosomes contributed by *B. calycinum*.

3461 Eid, S. E. ['Aid, S. ul D.]
**Preservation of the stainability of the chromosomes in material fixed in acetic-alcohol.**
Egypt. J. Bot. 1958 : **1** : No. 1 : 93–96.

A technique is described which rectifies the defect of the deterioration in stainability with carmine shown after some time by the chromosomes of material fixed in acetic alcohol. It involves the use of iron-acetic-alcohol as fixative and during storage. Material of *Allium*

spp. has been successfully stored for periods up to three years. The preservation of staining capacity may possibly be attributable to a coating of iron on the chromosomes.

3462 Braendle, D. H., Gardiner, B. & Szybalski, W.
**Heterokaryotic compatibility in *Streptomyces*.**
J. gen. Microbiol. 1959 : **20** : 442–50.

Further investigations [cf. XXVIII, 1197] on *S. fradiae* have revealed the occurrence of the following compatibility system. When $10^8$ conidia of each of two freshly isolated auxotrophic mutants were mated on a minimal medium, a small number (usually 1–10) of primary prototrophic heterocaryotic colonies appeared (low-frequency mating, LFM). When secondary parental isolates derived from the conidia produced by primary heterocaryons were mated, the frequency of heterocaryon formation increased by a factor of several thousand. This high-frequency mating (HFM) was a fairly stable property, decreasing or increasing in a stochastic manner, only after a considerable number of subcultures. The origin of LFM and HFM isolates is attributed to mutation, the fluctuations in frequency of heterocaryon formation in serial transfer being interpreted on the basis of selective advantage of one or other of the two types of mutants and of back mutants. More effective anastomosis, not increase in residual growth of the secondary parental isolates, and thus more opportunity for hyphal contact, appeared to be responsible for the HFM property. Even when an HFM stock of *S. fradiae* was used, no interspecific crosses were successful. Heterocaryotic interaction between independently isolated auxotrophic mutants derived from the same line of *S. fradiae* appeared, however, to increase when an HFM strain was one of the components.

3463 Čel'cova, L. P.
**(Cell multiplication during leaf development in wheat and onion).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 243–50. [Russian].

Various forms of amitotic cell division, including those in which chromosomes are formed but the full mitotic cycle is not consummated, are described.

3464 Lima-de-Faria, A.
**Matrix and kinetochore in living material.**
Hereditas, Lund 1959 : **45** :463–65.

From the author's own studies on *Tradescantia paludosa* and from the findings of other investigators it is concluded that cinetochores are divided before the metaphase of mitosis and that the matrix is involved in holding together sister chromatids; the matrix is a dense material which forms part of a chromosome but is distinct from the microfibrils, the filaments of the core and the chromonema.

3465 Wada, B. & Satô, S.
**Electron microscopic figures contributing to the analysis of the chromosome movement in anaphase.**
Nucleus, Calcutta 1958 : **1** : 173–82.

Electron-microscope examination of PMC preparations of *Lilium* and *Magnolia* showed the following. (1) The spindle may be regarded as containing fibrillar components, chromosomal fibres and chromosomes. The unit fibrils have a width of about 100–500 Å. and it was concluded that they had been homogeneously present in the spindle cavity and had been oriented parallel to one another along the longitudinal axis of the spindle when the cell was alive. The cytoplasm was quite distinct from the atractoplasm or ground substance of the spindle and showed no fibrillar components. (2) Each chromosomal fibre, seen as a single long thread between the centromere and spindle poles, appeared as a bundle of 15–20 lines of fine fibrils, the width of each fibril ranging from 200 to 700 Å. (3) No other fibres besides the chromosomal ones were observed. The spindle fibres and so-called continuous fibres featuring in classical cytology are regarded as artifacts. (4) The spindle ground substance could be seen to be delimited from the cytoplasm by the surface membrane of the spindle. These observations support the authors' hypothesis concerning the spindle mechansim, based on data from mitotic cells examined *in vivo* under the ordinary microscope, as reported in several earlier papers.

3466 Foster, T. S. & Stern, H.
**The accumulation of soluble deoxyribosidic compounds in relation to nuclear division in anthers of *Lilium longiflorum*.**
J. biophys. biochem. Cyt. 1959 : **5** : 187–92.

Further assays of anthers of *L. longiflorum* have indicated that periods of DNA synthesis in microsporogenesis and pollen maturation were associated with marked accumulations of methanol and acid-soluble deoxyribosidic compounds [cf. 1228]. A qualitative difference was detected between the deoxyribosidic compounds found at

meiosis and mitosis. During meiosis, phosphate-activated compounds were present only in trichloroacetic-acid extracts. Such compounds were extracted by acidified methanol from microspores undergoing mitosis. Reasons are given for concluding that the accumulations are directly related to chromosomal DNA synthesis. DNA synthesis in the microspores appeared to be related to a breakdown of DNA in the tapetal cells. Except for an unexplained decline in concentration during the interval of microspore mitosis, RNA underwent a progressive accumulation in the developing anthers.

3467 Nasatir, M.
**Changes in respiration and fermentation associated with microspore mitosis in *Lilium longiflorum* Thunb.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3364 : p. 652. (Abst.).

Respiratory and fermentative activities changed in relation to mitosis, a respiratory minimum and maximum being associated with division. The data suggested that respiratory activity occurred during chromosome duplication. It was not clear, however, to what extent chromosome movement depended upon premitotic respiratory energy. In addition, an indication was obtained that the normal pathways of oxidative phosphorylation were altered during the premitotic period. The results from the investigation of fermentation, as measured by glyceraldehyde-3-phosphate dehydrogenase activity, were consistent with the theory that increased glycolysis leads to mitosis.

3468 Stern, H.
**Mitosis and metabolic organization.**
Bot. Rev. 1959 : **25** : 351–84.

Surveying literature on higher plants and microorganisms, the author interprets the nature of metabolic events associated with various aspects of mitosis. The bibliography contains 116 references.

3469 Stebbins, G. L.
**Cellular differentiation through asymmetrical mitosis and mitotic induction in the developing epidermis of the grass leaf.**
Science 1959 : **129** : 1289–90. (Abst.).

The author describes the role of asymmetrical mitosis in the differentiation of the guard and subsidiary cells of the stomata in leaves of Gramineae, exemplified by barley, cocksfoot, maize and sorghum, Attention is drawn to the significance of the mode of differentiation under consideration as a tool in studies of developmental genetics.

3470 Schaechter, M., Bentzon, M. W. & Maaløe, O.
**Synthesis of deoxyribonucleic acid during the division cycle of bacteria.**
Nature 1959 : **183** : 1207–08.

The results of an autoradiographic analysis of *Escherichia coli* and *Salmonella typhimurium*, using tritiated thymidine and cultures growing exponentially, led to the conclusion that DNA synthesis occurs during over 80% of the division cycle. It is therefore suggested that the discontinuous pattern of DNA synthesis found in experiments in which synchronous division has been induced is artificial and that considerable caution is required in interpreting data from such experiments in terms of the normal division cycle.

3471 Evans, H. J., Neary, G. J. & Tonkinson, S. M.
**The effect of oxygen on the induction by gamma radiation of mitotic delay in root tip cells of *Vicia faba*.**
Exp. Cell Res. 1959 : **17** : 144–59.

Root-tip cells of *V. faba* were given doses of $\gamma$ radiation of up to about 200 rads. No qualitative difference between radiation effects under anaerobic and aerobic conditions was found; the ratio between the dose given in nitrogen and the dose given in air producing equal mitotic delay was between 1·9 and 2·0. The earlier the stage of interphase at the time of irradiation, the greater was the mitotic delay; cells already in mitosis were not delayed during that mitosis but were delayed in reaching the next mitosis. It is thought that mitotic delay may be due to interference with some specific cellular systems having a continuing function throughout the mitotic cycle.

3472 Evans, H. J. & Tonkinson, S. M.
**A paradoxical effect of aeration on the accumulation of root-tip metaphase cells by spindle inhibitors.**
Exp. Cell. Res. 1959 : **17** : 262–71.

Colchicine, p-dichlorobenzene, α-bromonaphthalene, acenaphthene and 8-hydroxyquinoline were compared in respect of efficiency for accumulating metaphases in root meristem cells of *Vicia faba*. Colchicine was found to be superior to the other spindle inhibitors. Fewer cells in metaphase were found in roots treated for brief periods in nonaerated colchicine solution than in those treated with an aerated solution. The differences were the result of a decrease in the rate of entry of cells into mitosis under anoxia. However, when p-dichlorobenzene was used, there was an increase in metaphase

accumulation in cells treated with nonaerated or deoxygenated solutions as compared with that found in cells treated with aerated solutions. It is suggested the cells may be less capable of detoxicating p-dichlorobenzene in the absence of air than in its presence and so the action of the spindle inhibitor is enhanced.

3473 Wilson, J. Y.
**Duration of meiosis in relation to temperature.**
Heredity 1959 : **13** : 263–67.

The duration of meiosis (leptotene to the tetrad stage) in *Endymion non-scriptus* at temperatures ranging from 0° to 30° C. was determined. Meiosis showed a marked shortening in duration with increasing temperature. Measured in days (24 hr.), the time ranged from 36·00 at 0° C. to 0·83 at 30° C. $Q_{10}$ values fell as the temperature rose.

3474 Venema, G.
De invloed van bestanddelen uit sigarettenteer op de kerndeling van *Allium cepa*. (**The influence of cigarette-tar components upon cell division in *A. cepa*).**
Genen en Phaenen 1958 : **3** : 85–91.

The effects on onion root-tip mitosis of aqueous solutions of tar components from cigarette smoke, from which the carcinogenic polycyclic hydrocarbons had been removed, were studied. With increasing concentrations the overall frequency of mitosis and the frequency of prophase decreased, while that of telophase increased. Spindle disturbances, fragmentation and overspiralization of the chromosomes were seen and there was some evidence of upsets in protein metabolism and RNA synthesis.

3475 Satô, S.
**Electron microscope studies on the mitotic figure. I. Fine structure of the metaphase spindle.**
Cytologia, Tokyo 1958 : **23** : 383–94.

Using PMCs of *Lilium longiflorum* and *Magnolia liliflora*, fixation with $CdCl_2$ proved to be highly satisfactory for preserving spindle structure at metaphase I in preparations to be examined under the electron microscope. The chromosomal fibres connecting the centromere and poles each consisted of a bundle of many fibrils, with an individual width ranging from 200 to 700 Å. No continuous fibres connecting the two poles could however be detected. The spindle elements consisted of unit fibrils about 100–500 Å. in width, oriented parallel to one another along the longitudinal axis of the spindle. The spindle body appeared to possess a surface membrane delimiting it from the cytoplasm.

3476 Endrizzi, J. E.
**The orientation of interchange complexes and quadrivalents in *Gossypium hirsutum* and *Eu-Sorghum*.**
Cytologia, Tokyo 1958 : **23** : 362–71.

Observations on the types and frequencies of zigzag and open rings in an interchange in *Sorghum vulgare* [cf. XXVI, 2350] and on the types and frequencies of quadrivalents in *S. vulgare* x *S. almum*, *S. vulgare* x *S. halepense*, *S. almum* x *S. halepense* and in *S. almum* [cf. XXVIII, 1688], together with the data reported by Chin on quadrivalent associations in autotetraploid *S. vulgare* [cf. XVII, 219], suggest that directional segregation of an interchange complex and of quadrivalents during meiosis is characteristic of members of *Eu-sorghum*. These observations are in agreement with Garber's hypothesis, based on investigations on *Para-sorghum* and *Stiposorghum*, that if a species displays directed orientation of an interchange complex at metaphase I, the quadrivalents of an autotetraploid of this species will likewise display directed orientation. The results of a study of *G. hirsutum* were however in disagreement with this hypothesis. In the case of 6 of the 12 translocations analysed, alternate and adjacent segregation occurred with equal frequency, while segregation in the case of the remaining 6 was directed. Chromosome-doubled *G. hirsutum*, of spontaneous origin, did not show directed orientation of quadrivalents. A general discussion is given of possible causes of directed and nondirected segregation. Data obtained by the author on *S. vulgare* x *S. almum* suggest that the type of configuration is determined at the time when the mutual repulsion of the centromeres begins. Additional information on chromosome associations and chiasma frequency in 8*x* *G. hirsutum* is also given, together with a consideration of the problem of estimating chiasma frequency in normal 4*x* *G. hirsutum*.

3477 Vasil, I. K.
**Nucleic acids and survival of excised anthers in vitro.**
Science 1959 : **129** : 1487–88.

Anthers of *Allium cepa* and *Rhoeo discolor* excised at leptotene-zygotene or diplotene-diacinesis were successfully cultured at 20° C. on modified White's medium supplemented with RNA or DNA. RNA gave better results than DNA. With an RNA concentration of

50 mg./l., anthers of *A. cepa* excised at diplotene-diacinesis contained 100% tetrads after 4 days. In both species, the development was induced only up to the formation of one-celled microspores. Division of the microspore nucleus did not occur even when the anthers were excised at the tetrad or one-celled microspore stage.

3478 Sire, M. W., & Nilan, R. A.
**The relation of oxygen posttreatment and heterochromatin to X-ray-induced chromosome aberration frequencies in *Crepis capillaris*.**
Genetics 1959 : 44 : 124–36.

It was found that, when resting seeds of *C. capillaris* were X-irradiated at 1500 r. or 3500 r. and treated with oxygen at 100 lb. pressure for periods up to 42 days, the frequencies of abnormal cells, dicentric chromosomes and acentric-rod and isodiametric fragments increased during the postirradiation treatment. Also nonirradiated seeds stored for 42 days in oxygen showed considerably more aberrations than the control which had not received the oxygen treatment. Storage in oxygen uniformly increased the frequencies of aberrations in all six arms of the three chromosomes but it appeared to inhibit rejoining; the ratio of breaks that did rejoin to those that did not rejoin decreased during postirradiation treatment.

The observed number of breaks leading to dicentrics was much greater than expected in the long arm of one chromosome, C, and less than expected in the long arm of A, assuming that the frequency of breaks in each arm is directly related to the length of the arm. Also there were more simple breaks than expected in the long arm of A and less than expected in the short arm of C; oxygen treatment did not affect this differential breakage. It was then found that breaks leading to dicentrics occurred in or near heterochromatic areas and simple breaks occurred in the euchromatic regions, and the observed frequencies of each type of break in each arm were proportional to the amounts of heterochromatin and euchromatin present. It is thought that breakage induced by X irradiation probably occurs at random in *Crepis* chromosomes; breaks tend to rejoin more in heterochromatin than in euchromatin and so the breaks in some chromosome arms appear to be nonrandom. The number of observed exchanges between homologous chromosomes fitted the expected value very well but the frequencies of chromatid breaks were higher than expected, most of these breaks occurring in the long arm of chromosome D.

3479 Wimber, D. E.
**Chromosome breakage produced by tritium-labelled thymidine in *Tradescantia paludosa*.**
Proc. nat. Acad. Sci. USA 1959 : 45 : 839–46.

Small rooted plants were grown (1) continuously in an aerated nutrient solution containing 1 $\mu$c./ml. $H^3$-thymidine for 4–56 hr. before root-tip fixation, and (2) in media containing 1 or 2 $\mu$c./ml. for 4, 6 or 8 hr., followed by transference to an isotope-free nutrient solution and fixation after 0–24 hr. of further growth. In treatment (1), the frequencies of anaphase fragments per 100 cells showed an abrupt increase in roots grown in the labelling solution for 20 and 24 hr., being respectively 19·4 and 35·6. The frequency then declined with longer treatments. Fragment frequency per 100 anaphases showed a roughly linear increase with autoradiographic grain number in dividing nuclei in roots treated for 24–56 hr. The mitotic index fell in roots which had been immersed in solutions for over 8 hr. Nuclei with grain counts of 80 or more were seldom found to be dividing. In root tips subjected to treatment (2), few fragments were found upon immediate examination. A significant increase in fragment frequency was however detected in roots fixed 12 and 16 hr. from the time of initial immersion in the isotope solution. The frequency generally showed a decline in roots fixed 20 hr. after commencement of treatment. The maximum frequency attained was 31·7 per 100 anaphase cells exposed for 8 hr. to 2 $\mu$c./ml. and collected 16 hr. after the beginning of treatment. The highest frequencies could be correlated with the period during which the maximum amount of $H^3$-thymidine was incorporated into the chromosomes during the mitotic cycle.

3480 Mitra, S.
**Effects of X-rays on chromosomes of *Lilium longiflorum* during meiosis.**
Genetics 1958 : 43 : 771–89.

PMCs treated with 15 and 30 r. at stages ranging from interphase to metaphase I were analysed with respect to relative sensitivity of the chromosomes to breakage as indicated by aberration frequencies at anaphase I. At both doses, the peak frequencies occurred in cells irradiated at preleptotene and at diplodiacinesis, chromosomes irradiated at the former stage being the more sensitive. Cells exposed to 60 r. at stages ranging from premeiosis to early pachytene were examined for aberrations at late diplotene and anaphase I. Reciprocal translocations

seen at late diplotene and dicentric chromatid types of aberrations between nonhomologous chromosomes accompanied by one fragment were respectively used as criteria of the chromosome and chromatid types. Only chromosome aberrations occurred in cells irradiated at early leptotene and earlier stages. Such aberrations ceased to be induced, possibly after early leptotene, and certainly before the beginning of zygotene. Chromatid breaks, on the other hand, appeared abruptly in cells treated at midpreleptotene. The time of chromosome reproduction, as indicated by the types of aberrations induced at different stages, coincided with the period of DNA synthesis. This time of reproduction is inconsistent with hypotheses of crossing over which demand a duplication of the chromosomes after pairing has occurred. The frequency of subchromatid bridges showed a sudden increase as the result of treatment (60 r.) at late pachytene, reaching a peak in cells irradiated at late diacinesis and decreasing in those treated at metaphase I. Aberrations induced 3 and 6 hr. before anaphase I were all of the subchromatid type. Sensitivity to the induction of subchromatid aberrations may be related to a change in the spatial relations of preexisting chromosomal units rather than to synthesis of new material.

3481 Giovannozzi-Sermanni, G. & Wittmer, G.
Su di un metodo per la crescita di test citologici in emulsioni oleose. **(A method of growing cytological tests in oil emulsions).**
Tabacco, Roma 1958 : **62** : 382–83.

In order to test the mutagenic activity of oils extracted from tobacco seeds it was necessary to grow the *Allium cepa* test plants in an aqueous emulsion of the oil. A suitable stable emulsion was produced by the use of the surface-action agent Rolfor C and the method is described.

3482 Wittmer, G.
Prime osservazioni sull'attività citologica dell'olio estratto da semi di *N. tabacum* e *N. rustica*. **(Preliminary observations on the cytological activity of the oil extracted from seeds of *N. tabacum* and *N. rustica*).**
Tabacco, Roma 1958 : **62** : 384–405.

Treatment of roots of *Allium cepa* with an aqueous emulsion of oil extracted from seeds of *Nicotiana tabacum* 'Maryland', in the presence of an emulsifier [cf. 3481] produced phenomena of chromosome agglutination which persisted for some time after the roots were transferred to tap water. Oil from fresh seeds had a more pronounced effect though the recovery in fresh water was quicker than in roots treated with oil from seeds collected in 1939, the action of which was more gradual. Oil from old seeds of *N. rustica* 'Tombac' had a mitoinhibitory effect which was not reversible in fresh water, the stickiness and other effects being more pronounced than in the corresponding treatments with oil from seeds of *N. tabacum*; a certain amount of fragmentation was also observed. Extraction at low temperature gave oils with greater effects than extraction at high temperature.
Controls treated with water containing the emulsifier alone or liquid paraffin and emulsifier showed no corresponding irregularities.

3483 Swanson, C. P. & Merz, T.
**Factors influencing the effect of β-propiolactone on chromosomes of *Vicia faba*.**
Science 1959 : **129** : 1364–65.

The chromosomes were most sensitive to the action of β-propiolactone (BLP) at early interphase. The observations suggested that the delay in mitosis caused by the chemical occurred principally at a stage prior to DNA synthesis and chromosome replication. The aberrations induced were entirely of the chromatid type. The action of BLP was unaffected by pH, oxygen tension or such metabolic inhibitors as $NaN_3$ and NaF, but was influenced by temperature, concentration and pretreatment and posttreatment with dinitrophenol. The higher the temperature (5°–37° C.) the higher was the frequency of breakage. Both pretreatment and posttreatment with dinitrophenol resulted in increased frequencies of aberrations. Of the various BPL concentrations tested, $7 \times 10^{-3}$ M was the most effective since it induced a high frequency of aberrations and caused a low frequency of cell death. BPL was preferential in its action, breakage usually occurring in the heterochromatic segments in the long arms of the short chromosomes. The few breaks induced in the long chromosomes were situated in the heterochromatic regions on either side of the centromere. The characteristics of the action of BPL are discussed in comparison with those of other radiomimetic compounds.

3484 Kihlman, B. A.
**On the radiomimetic effects of cupferron and potassium cyanide.**
J. biophys. biochem. Cyt. 1959 : **5** : 351–53.

As in earlier experiments [cf. XXVIII, 83], the

effect of cupferron in inducing chromosome aberrations in roots of *Vicia faba* proved to be independent of the oxygen concentration (1–100%), whereas that of KCN increased as the oxygen concentration became higher. In an atmosphere of oxygen-free nitrogen, both cupferron and KCN showed no radiomimetic action. Unlike KCN, cupferron was strongly influenced by temperature and pH in its induction of aberrations. The effect of cupferron was enhanced when the temperature during treatment was increased or when the pH of the solution was reduced. Possibly the differences in the effects of temperature and pH upon the action of cupferron and KCN are a reflection of disparities in ability to penetrate the cell membrane. The different response to oxygen is discussed with reference to the possible role of organic peroxides in inducing aberrations and to the alternative hypothesis that aberrations may arise through the reactions of the compounds with heavy metals present in the chromosomes. Other explanations are however under consideration.

3485 Sáez, F. A. & Drets, M. E.
**The action of gonyleptidine on the mitotic and meiotic chromosomes and on the interphase nucleus.**
Portug. acta biol. : Sér. A. : 1958 : **5** : 287–95.

The above volatile substance, extracted from cutaneous glands of *Heteropachylloidellus robustus*, has antibiotic properties and when tested on onion root-tips and on the gonads of *Laplatacris dispar* caused c-metaphases, polyploidy, agglutination, chromosome fragmentation, diffusion of DNA into the cytoplasm and other aberrations. It is noted that the sex chromosome of *L. dispar* did not become agglutinated to the autosomes.

3486 Wakonig, R. & Arnason, T. J.
**Chromosome breakage induced in *Vicia faba* root tips by 2,4,6-tri(ethyleneimino)-1,3,5-triazine.**
Canad. J. Bot. 1959 : **37** : 403–11.

Some of the results of this investigation have already been summarized [cf. 1125]. After a 12-hour treatment of root tips in a $10^{-5}$ M solution of 2,4,6-tri (ethyleneimino) - 1,3,5-triazine (TEM) at 20° C., up to 29% and 31% of the cells in *V. faba* and *Allium cepa*, respectively, had bridges or fragments at anaphase. Unlike *A. cepa*, *V. faba* has appreciable amounts of heterochromatin. Since the results obtained for the two species were mostly similar, it may be concluded that TEM affects chromosomes regardless of the presence or absence of heterochromatin. The analysis given of metaphase aberrations is based on *V. faba*. The most abundant aberrations at metaphase were chromosome breaks and chromatid interchanges. Aberrations were more numerous after a 6-hr. treatment with $2 \times 10^{-5}$ M than after a 12-hr. treatment with $10^{-5}$ M. The peak frequencies of aberrant metaphases were reached 36 hr. after treatment with $2 \times 10^{-5}$ M and slightly earlier in the case of weaker solutions. Many chromosomes had incomplete breaks. Sister reunions of chromatids occurred with equal frequency in centric and acentric fragments. Sister reunion was 1·5 times as frequent as chromatid exchange. The distribution of breakage points in the satellite chromosome of treated *V. faba* was also determined. Along the length of this chromosome, breaks took place at random except for a slight favouring of the heterochromatic region. Per unit of length the short chromosomes were about three times as prone to breakage and exchange as the pair of satellite chromosomes. Immersion of the cut stems of *Tradescantia paludosa* in TEM solutions for 1–5 days had no discernible effects on the chromosomes in the microspores.

3487 Niitsu, T.
**The effect of chemicals on mitosis studied in *Tradescantia* cells *in vivo*. IV. 2 methylamino 1.3 diaza-azulene with special reference to its effect on cytokinesis.**
Cytologia, Tokyo 1958 : **23** : 372–82.

Nuclei with doubled chromosome number were induced in staminal-hair cells treated at prophase and prometaphase with concentrations of the above compound higher than $5 \times 10^{-3}$ M. Treatment at metaphase with this concentration resulted in binucleate cells. Multinucleate cells with multiple septa appeared at telophase in cells treated at prophase and prometaphase with a concentration of $1 \times 10^{-3}$ M. The abnormalities induced are interpreted on the basis of two specific effects: (1) deformation and inactivation of the spindle body and (2) suppression of phragmoplast development.

3488 Wilson, G. B., Sparrow, A. H. & Pond, V.
**Sub-chromatid rearrangements in *Trillium erectum*. 1. Origin and nature of configurations induced by ionizing radiation.**
Amer. J. Bot. 1959 : **46** : 309–16.

A detailed account is given of the results of

investigations which have already been briefly reported [1137].

3489 Koo, F.K.S.
**Expectations on random occurrence of structural interchanges between homologous and between nonhomologous chromosomes.**
Amer. Nat. 1959 : **93** : 193–99.

Assuming that breakages and recombinations occur at random after irradiation treatments, an expression for calculating the expected ratio of rings and pseudoisochromosomes is derived; the expected ratio for an organism with $N$ pairs of chromosomes is $4(N–1) : 1$. Data obtained from experiments with maize and barley gave ratios which agreed well with the expected values with two exceptions; thus in general interchanges between homologous and nonhomologous chromosomes appeared to be random.

3490 Beatty, A. V. & Beatty, J. W.
**Metabolic inhibitors and chromosome rejoining.**
Amer. J. Bot. 1959 : **46** : 317–23.

"X ray-induced chromosomal aberrations of the dicentric and ring types in the first microspore division in *Tradescantia paludosa* were used to study the effects of temperature and chemical substances acting as metabolic modifiers on rejoining under both aerobic and anaerobic conditions. A total dose of 400 r of x rays was administered at 50 r/min. at temperatures ranging from 0·3° C. to 45° C. In the aerobic temperature experiments, 5% oxygen was used in either helium or carbon monoxide and in the anaerobic ones helium was used. In 5% oxygen in helium, the highest number of aberrations was produced at the lowest temperature. When the amount of oxygen in solution was made constant at all temperatures by adjusting the positive pressure of gas in experiments carried out above zero degrees, there was a temperature effect at 0·3° C. and 10° C., but no effect from 20° C. to 45° C. Temperature was believed not to influence chromosome breakage but only rejoining, through its influence on oxidative metabolism, thereby removing the source of energy. In the anaerobic temperature experiments, a low aberration yield of 0·14 occurred at 0·3° C., while a high 0·66 was recorded at 40° C. Cytochrome oxidase was found not to be involved in the energy supply for rejoining in anaerobic experiments, since exposures in alkaline pyrogallate - washed carbon monoxide gas gave the same results as helium, indicating that both gases only provide anoxic conditions. Under anoxic conditions, pretreatment in M/1000 sodium iodoacetate or M/10,000 p-chloromercuribenzoate solutions had no effect on non-irradiated plants thus treated, but increased the average number of chromosome aberrations per cell produced by x rays at least 2-fold over the irradiated controls. The effect of these 2 salts, as used in these experiments, is believed to have taken place through their inactivation of triosephosphate dehydrogenase, thus inhibiting glycolysis at an early stage before any energy was released."
[Authors' summary].

3491 Paliwal, R. L. & Hyde, B. B.
**The association of a single B-chromosome with male sterility in *Plantago coronopus*.**
Amer. J. Bot. 1959 : **46** : 460–66.

Male-sterile plants of *P. coronopus* ($n = 5$) contained a B chromosome which was shorter than any of the other chromosomes and largely heterochromatic. Meiosis was regular. At meiosis I, the accessory usually passed undivided to one pole, dividing during meiosis II. The microspores degenerated before pollen mitosis. The ♂ sterile plants were apomictic. The results of several generations of controlled crossing indicated that ♂ sterility in *P. ovata* ($n = 4$) was probably cytoplasmic.

3492 Baranov, P. A. & Matveeva, T. S.
**(Polyploidy as a method of experimental botany).**
Bjull. Glavnogo Bot. Sada (Bull. Princ. Bot. Gdn.), Moskva-Leningrad 1958 : No. 31 : 49–57. [Russian].

Attention is called to the greater physiological activity of polyploid cells, which is frequently observed for instance in cases of endopolyploidy; also to their greater resistance to unfavourable influences, including radiation. The greater variety of essential oils in polyploid mint, the greater penetrating powers of the hyphae of polyploid fungi and the tendency towards perennial habit and vegetative reproduction in polyploid forms in general are also mentioned. The different genetic ratios observed in diploid and polyploid forms are pointed to as one of the clearest demonstrations of the validity of the chromosome theory of inheritance.

3493 Martin, P. G.
**Apparent self-fertility in *Neurospora crassa*.**
J. gen. Microbiol. 1959 : **20** : 213–22.

"Single ascospores which gave rise to temporarily self-fertile cultures were found in *Neurospora crassa*. Genetical and cytological evidence suggested that these ascospores were disomic

for the chromosome containing the mating-type locus, the disomy having arisen following partial desynapsis at meiosis and unequal distribution of univalents. At some time after germination, the nuclei reverted to the haploid state. If the disomic ascospore had been heterozygous at the mating-type locus, two sorts of haploids might occur and fertility probably resulted from mating between these."

[Author's summary].

## GENERAL BOTANY

3494 Stanley, W. M.
**The nature of viruses, cancer, genes, and life—a declaration of dependence.**
Ann. Rep. Smithson. Instn. 1957 (1958) : 357–70.

The author draws upon evidence in support of the views that viruses may act as genes and genes as viruses, that viruses are able to cause cancer and that viruses are characterized by properties of both living matter and molecules. Viruses, cancer, genes and life have a common feature in that they are all dependent on nucleic-acid structure. Elucidation of the structure of nucleic acid in all its aspects is regarded as a considerably more important scientific problem than that of the structure of the atom.

3495 Takemaru, T.
**(Genetical studies on fungi. VII. Mating system of *Coprinus macrorhizus* f. *microsporus*).**
Shokubutsugaku Zasshi/Bot. Mag., Tokyo 1959 : **72** : 169–76. [Japanese].

This form has a tetrapolar mating system but limited dicaryotization occurs when the *B* factors of the mated mycelia are identical. In this latter case, the barrage effect is shown when the mated mycelia are inoculated 1–2 cm. apart; when the inoculated mycelia are in contact, dicaryotic sectors occasionally occur. [Cf. 1170].

3496 Brock, T. D.
**Biochemical basis of mating in yeast.**
Science 1959 : **129** : 960–61.

One mating type of *Hansenula wingei* possesses a specific protein on its cell surface, which is complementary to a specific polysaccharide on the cell surface of the opposite mating type. The initial, agglutinative phase of mating therefore bears an analogy to a reaction between an antibody and a polysaccharide antigen.

3497 Brewbaker, J. L. & Shapiro, N.
**Homozygosity and *S* gene mutation.**
Nature 1959 : **183** : 1209–10.

Investigations on *Petunia inflata* have shown that homozygotes and heterozygotes for various *S* alleles differ in mutability at locus *S*, with or without X irradiation. The frequencies of mutation per million viable pollen grains were roughly estimated as follows from data derived from buds treated before meiosis and from the controls: control homozygote, 9·9; homozygote (1000 r.), 21·4; control heterozygote, 84·0; and heterozygote (1000 r.), 1320·0. The rates of mutation resulting from X irradiation after meiosis did not differ significantly from the control frequencies. The low rate of mutability in postmeiotic haploid cells may be explained by assuming that a large proportion of *S* mutation depends on heterozygosity for *S* alleles within the target cell. Such a possibility sheds doubt on the validity of employing frequencies of *S* mutation in heterozygotes to define the time of *S* gene action. Alternatively, it may be argued that *S* action in the pollen occurs as late as the second mitotic division, such timing accounting for the difference in site of inhibition of binucleate and trinucleate grains [cf. XXVIII, 2527]. The behaviour of 12 of the mutants studied provided support for Lewis's hypothesis that the *S* locus is bipartite, with separable units respectively controlling pollen and stylar activity. One other mutant plant was of particular interest, reacting as if the altered allele was a cross-over recombinant with the pollen activity of $S_1$ and the stylar activity of $S_2$. The authors' observations may be interpreted as evidence that the relatively high mutability of heterozygotes is the outcome of genetic interchange. Equal crossing-over or gene conversion may be expected to lead to mutants only in *S* heterozygotes. Alternatively, if the locus comprises synaptically equivalent stylar and pollen units, unequal crossing-over could lead to "part mutation of pollen in heterozygotes by assembling on the same chromosome two alleles or pollen-units which interact by competition in the pollen." Unequal crossing-over could also result in "partly deficient pollen gametes in both homozygous and heterozygous plants."

3498 **Symposium on Apomixis.**
Proc. Linn. Soc. Lond. 1959 : **170** : 172–77.

Apomixis is the subject of current discussions at meetings of the Taxonomic Principles Committee of the Systematics Association. Two relevant items are given here: Apomixis

and evolution, by P. C. Sylvester-Bradley, and Apomictic potentialities in *Dactylorchis* by J. Heslop-Harrison. In the former, a summary is made of some of the general conclusions emerging from the meetings. The importance of viewing the phenomenon of apomixis in the perspective afforded by geological time is stressed. Since groups predominantly composed of obligate apomicts occasionally produce individuals capable of some degree of sexual reproduction, apomictic clones may be regarded as long-lived individuals in an intrabreeding population. The apomictic complex may thus be interpreted as the result of a response to a particular change in environmental conditions, i.e. to the relatively sudden cessation of stabilizing selection pressure. "It has become customary to regard an agamic complex as a 'blind alley' of evolution. An alternative hypothesis would seem, viewed in the geological perspective, to be just as likely. According to this hypothesis, the complex may pass through two stages. First, the onset of inclement conditions will lead to disruptive selection pressure, and the topographical isolation of small communities. Thereupon directional selection pressure will start operating independently on each community. Those that contain individuals which can regain sexual reproduction will respond by divergence. Those that fail to do so will become extinct. Seen in this light, the agamic complex is no blind alley; it is the first stage of an explosive burst leading to adaptive radiation."

## CROP PLANTS

3499 Sandison, A., & Bartlett, B. O.
**Comparison of varieties for yield.**
J. nat. Inst. agric. Bot. 1958 : **8** : 351–57.

Statistical aspects of the procedure employed in trials carried out at the National Institute of Agricultural Botany, Cambridge, England, and subsidiary centres are analysed. "N.I.A.B. trials have confirmed that between trials error is greater than within trials error. From the standard errors of 588 means of the percentage yields of cereal varieties the between trials standard deviation $\sigma$ averaged 10·3 per cent. and from 41 potato means 14 per cent. Different controls led to differences in the value of the standard deviation, but values based on one or on several seasons were similar. Comparable figures for the between trials error were obtained from 48 analyses of variance of cereal trial series ($\sigma = 8{\cdot}9$ per cent.), and when estimated from percentage differences between 376 pairs of cereal varieties and the observed number of occasions when the one outyields the other as a measure of the probability of the one giving higher yields ($\sigma = 12{\cdot}6$ per cent. for wheat, barley and oats 25 per cent. for grain maize). "A table is given for the approximate differences necessary for significance at $P$ 0·05 for comparing two varieties by their mean yields as percentages of a common control with the standard errors of the two means.

"It is concluded that about 20 cereal trials are necessary for a 5 per cent. difference from the control to be significant at $P$ 0·05, and about 30 trials for 4 per cent. to be significant. To prove regional differences substantial numbers of trials will be necessary in each of the types of environment being compared."

[Authors' summary].

3500 Varuncjan, I. S.
**(On the use of radiation in breeding).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 140–56. [Russian].

Research by western geneticists on the use of ionizing radiation in plant breeding during 1944–1956, which has now been published in Russian, is reviewed. Extracts from the text are cited in support of the writer's Mičurinist contention that practical results are very meagre. N. P. Dubinin, V. M. Klečkovskij and other Russian research workers are criticized for complaining that the Soviet Union lags behind other countries in this kind of research and for advocating its resumption. The writer concludes by restating Lysenko's views on the use of X-rays and other strong agents in breeding research. [XVIII, 2000].

3501 Preobraženskaja, E. I.
**(The relative resistance to radiation of different species of cultivated plants).**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 68–74. [Russian].

Dry seeds of a number of cultivars belonging to different families were irradiated with $\gamma$ rays from $Co^{60}$. The most susceptible species among those treated was *Perilla ocymoides*, for which a dose of 25,000 r. was almost lethal; other sensitive species were *Vicia faba*, *Pisum sativum*, *Phaseolus vulgare*, *Zea mays*, *Phleum pratense*, *Arrhenatherum elatius*, *Agropyron repens*, *Secale cereale* and *Triticum vulgare*. The most resistant were the majority of the species in the Cruciferae, certain small-seeded forms in the Leguminoseae, *Linum usitatissimum*, *Ricinus persicus*, *Nicotiana rustica*, *Sesamum indicum*, *Lallemantia iberica* and *Cucumis sativus*.

In certain families marked differences were observed between cultivars within a species; this applied particularly to the leguminous and gramineous species.
No correlation was observed between radiosensitivity and the oil content of the seeds.

3502 Fujii, T. & Matsumura, S.
**Radiosensitivity in plants. I. Determination of LD-50 in cultivated plants (preliminary report).**
Idengaku Zasshi/Jap. J. Genet. 1958 : **33** : 389–97.

Information is provided on the germination rate and seedling survival shown by 43 cultivated species when their dry dormant seeds were exposed to doses of $\gamma$ rays from a $Co^{60}$ source ranging from 20 to 100 kr. for 18 hr. As might be expected, differences in radiosensitivity were found between families, between genera in the same family and between species in the same genus. Differences were however also noted between commercial varieties within the same species, such as *Oryza sativa*, *Hordeum sativum*, *Zea mays*, *Raphanus sativus* and *Glycine max*.

3503 **Field experiments, 1956.**
J. Dep. Agric. Éire 1957–58 : **54** : 244–51.

A report is provided on the results of trials carried out by county instructors at many centres in the Irish Republic on: the spring wheats Atson, Svenno and Peko, with Atle as control; spring oats Rex, Blenda and Pendek, with Glasnevin Triumph as control; three spring-barley selections from Spratt-Archer x Kenia (17/8, 33 and 115) against Herta [cf. 3601 and 3600]; and the forage beets Hunsballe XI, Hinderupgaard and Pajbjerg Rex XI.

3504 **Crops and plant breeding.**
J.R. agric. Soc. 1958 : **119** : 90–104.

Among the topics dealt with in this review of recent work on crops in the United Kingdom are varietal trials and breeding of cereals and lucerne.

**Report of the Rothamsted Experimental Station for 1958** (1959) : Pp. 283.

3505 *Watson, D. J. Botany Department. Varietal differences in barley.* (*pp. 82–83*).

It has already been suggested that the barleys Proctor and Herta produced higher grain yields than Plumage Archer because their ears carried out more photosynthesis [364]. It is assumed that photosynthetic capacity is correlated with the size and weight of parts of the ear other than the grain, and the ear : shoot dry-weight ratios of the different varieties were measured when the ears were beginning to emerge and at anthesis; at these stages the weight of the grain was negligible. The ear : shoot ratios for Proctor and Herta were found to be consistently less than that for Plumage Archer at these stages of development but at maturity this difference was reversed and the ratio was higher for Herta and Proctor. These results suggest that the greater dry matter production of the ears of these two varieties is not attributable to greater photosynthetic capacity of the ears. It appears that the ears of Proctor and Herta have a higher photosynthetic efficiency than those of Plumage Archer.

3506 *Gregory, P. H. Plant pathology department.* (*pp. 96–111*).

When leaf axils of glasshouse potato plants were inoculated with a droplet of spore suspension of *Phytophthora infestans*, the varietal differences in stem and petiole susceptibility observed in 1957 were confirmed [cf. 151]. Field and laboratory investigations gave similar results and the test was extended to 33 varieties of all maturity groups; varieties differed in susceptibility but further experiment is necessary to determine the reliability of this test. Evidence was obtained that more spores are produced on some varieties than on others. In Arran Viking growing in the field, the width of the spore-producing zone increases as the lesion grows but in the susceptible variety Up to Date the average width of the sporing zone is similar irrespective of the size of the lesion. The resistant varieties Ackersegen and Ås like Arran Viking produce relatively few spores on the smaller lesions. In a test of 32 commercial varieties grown in small field plots, Ackersegen, Ås and Ontario remained green longest and gave reduced sporulation. Also in an experiment with the hypersensitive varieties, Orion, Ulster Torch and Pentland Ace, only Orion showed some foliage and tuber resistance when inoculated with its specialized race. The leaves of the middle and upper canopy of Ulster Torch abscissed readily when partially infected; the fallen leaves produced many spores in the furrows and at lifting 19% of the tubers were blighted.
Ninety pea varieties were grown in soil naturally infected with *Fusarium oxysporum* f. *pisi* and 50% of the varieties were found to be highly susceptible to wilt. Some of these susceptible varieties had previously been found resistant in Holland and in New Zealand; this indicated probable differences in the geographical distribution of physiological races of the pathogen. Including the results of other observations, the

reaction of 143 pea varieties to wilt in Britain is now known; of these, 60 are susceptible. No correlation between wilt resistance and any particular morphological feature has been found. Some susceptible seed stocks yielded a few resistant plants which could be tested for suitability as breeding material. Tests in the glasshouse showed that most methods of inoculation gave results which were unreliable guides to field reaction; it is therefore unlikely that the selection of resistant stocks can be effected in this way.

3507 *Hill, M. J. & Moffatt, J. R. Summary of cereal variety trials at Rothamsted and Woburn, 1955–58.* (*pp. 180–84*).

In the trials of spring wheats, Koga II usually outyielded the other five varieties. With regard to the mean yields for the period 1955–57, Koga II was the best variety at both high and low levels of nitrogen but at the high level it was closely rivalled by Svenno. Svenno gave the greatest response to nitrogen. In 1956 when some varieties lodged badly, Peko and Koga II headed the list with respect to straw strength. Strength of straw was not in all cases associated with shortness of straw; Koga II combined both these features. Of the winter wheats, Cappelle has consistently outyielded all others except Leda in 1957. Leda is very good on lands of low to medium fertility but will not stand high levels of nitrogen. The standard barley varieties Herta and Proctor outyielded the others tested.

Tätigkeitsbericht der Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V. für die Zeit vom 1.4.1956 bis 31.3.1958. (**Report on the activity of the Max Planck Society for the Promotion of Science for the period from 1 April 1956 to 31 March 1958**). Naturwissenschaften 1958 : **45** : 581–619.

3508 *Max-Planck-Institut für Züchtungsforschung (Erwin-Baur-Institut).* [*Max-Planck Institute for Research on Breeding (Erwin-Baur-Institute)*]. *pp. 618–19.*

A detailed list is given of the problems which have been investigated in plant breeding and genetics.

3509 Tomme, M. F.
[**At the German Academy of Agricultural Sciences in Berlin (German Democratic Republic)**].
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 119–22. [Russian].

Varieties of wheat, oats, potato, sugar beet, peas and beans bred at the above institute and its branches are mentioned, also a white clover free from coumarin and polyploid forms of red clover with short corolla tubes.

3510 Maiss, I. & Koehler, G.
Pflanzenzüchtung und Saatgutproduktion in der Deutschen Demokratischen Republik. (**Plant breeding and seed production in the German Democratic Republic**).
Dtsch. Landw., Berl. 1959 : **10** : 231–33.

A brief mention is made of work being carried out at various breeding stations in the German Democratic Republic on cereal, fodder, root, fibre, fruit and vegetable crops.

3511 Carrante, V.
Aspetti agronomici della Murgia Barese. (**Agronomic aspects of the Murgia of Bari**).
Stazione Agraria Sperimentale, Bari 1956: Pp. 179.

A detailed account of the climatic, geological and agricultural conditions of this area of southern Italy is presented.

In the chapter on improvement of fruit trees, vines and herbaceous crops it is pointed out that too many varieties of almond are at present in cultivation and those that can be recommended for planting are named; they are Truono, Jascettua, Occhiorosso [Red-eye], Filippocea, Montrone, Rachele and Biancolla.

Among the olives, the variety Coratina is recommended above all others.

The most popular grape varieties are Rosato di Castel del Monte, Troia, Pampanuto and Malvasia, the rootstocks being Rupestris du Lot or Berlandieri Riparia 420A.

The wheat Bianchetta Conti 83 remains unsurpassed in the bread wheats and Grifoni 235 in *Triticum durum.*

3512 Estación Experimental de Aula Dei. Departamento de Mejora. Ensayos 1957–1958. (**Experimental Station of Aula Dei. Department of Breeding. Trials, 1957–1958**). Pp. 41. (Mimeographed).

**Wheat.** The selections MM-7, MM-2 and MM-4, from segregating forms from populations of Aragón O3, have compared favourably in yield with Aragón O3, as have also Canaleja and Aradi; all are recommended for unirrigated conditions in Aragón. Under irrigated conditions, the selections 8, 11, 10 and 6 from L–4 x Hope were superior to Pané 247 and are being multiplied.

**Oats.** Cartuja, from 0355 x Gopher, and La Previsión have yielded well on irrigated land.
**Barley.** The productivity of Albacete 1 on unirrigated land has been confirmed. Ricla 2a, Rosa and Compacta 4 were superior to La Almunia under irrigated conditions.
**Forage crops.** Varieties of grasses, legumes and *Sanguisorba minor* of varying provenance have been studied with respect to their growth cycle, hardiness, drought resistance and hay production. Selections of vetch have been compared.
**Sugar Beet.** In tests of introduced and native polyploids and diploids, the tetraploid AD–742 showed high resistance to *Cercospora beticola*. Triploids have been produced from crosses of AD–742 with Ebro 130–43, Ebro M–51 and Janasz and of AD645 (4*n*) with AD–607.

3513 Jalkanen, P. I. & Linnomäki, J. H.
Viljakasvien ja herneen lajikevertailut Hämeen koeasemalla v. 1935–55. (**Comparison of cereal and pea varieties at the Häme experimental station, 1935–55**).
Valt. Maatalousk. Tiedon. 1957 : Pp. 20.

Field trials are described and analysed; comparative data are given for the following crops.
**Spring wheat.** Compared with Timantti [Diamond] as standard, the early varieties Norröna, Apu [Aid] and Jo 02088 are highest yielding, the last of these being the best in straw quality. Of the later varieties, Kärni [Kernel] and Svenno yield well in some seasons, but tend to be too late, as is Timantti II. The line Ta a4656 gave a significantly higher yield than the standard, has good straw stiffness and is only slightly later than Timantti. W5209 also shows promise in yield and straw quality and is somewhat earlier ripening.
**Winter wheat.** This crop gives poor results owing to unsuitable soil. Vakka [Bushel] is reported to combine good straw with overwintering qualities and earliness.
**Oats.** Sisu [Courage] is the highest yielding although too late as a reliable crop in cold districts. Earlier varieties with satisfactory yield are Eho and Pendek which also have good straw qualities.
**Winter rye.** Varieties are compared with Toivo [Hope] as standard. Highest yields are obtained from Onni II [Fortune II] and Oiva [Excellent] but satisfactory winter hardiness is found only in Toivo, Oiva, Ensi and the local strain Myttäälä. Strength of straw is unsatisfactory in these; it is highest in Sangaste.
**Barley.** Varieties were compared with both Balder and Binder. Balder is surpassed in yield only by the lines Jo 0640 and Ta a8098, both of which have poorer straw. Pirkka and Tammi are recommended as early varieties with good strength of straw.
**Pea.** These are compared with Torsdag II. Kalle is favoured for quality and yields well. Artturi and Hohenheim are high-yielding fodder peas.

3514 Liepa, J.
Stendes selekcijas stacijas darbība. (**Research at the Stende Breeding Station**).
Augsne un Raža, Rīgā 1958 : **7** : 41–58.

The oat Ligo and the red clover Stendes vēlais II [Stende Late II] are among the varieties of crop plants bred in recent years at Stende [cf. 3980 and 3758].

3515 Krēsliņš, A.
Priekuļu selekcijas un izmēģinājumu stacijas paveiktais darbs. (**Progress report of the Priekuļi Breeding Research Station**).
Augsne un Raža, Rīgā 1958 : **7** : 59–77.

High-yielding varieties of wheat, oat, rye, barley, *Dactylis*, timothy, ryegrass, fescue and potato, which are adapted to the climatic and soil conditions in Latvia, are listed. They were all bred at Priekuļi. Promising varieties still under trial include a buckwheat and a pea.

3516 Veisteris, P.
(**Horticultural work at the Puri Research Station**).
Augsne un Raža Rīgā 1958 : **7** : 88–91. [Russian].

Breeding of fruit trees, soft fruits, vines and vegetables is discussed and reference is made to new tomato varieties which are tolerant of — 5·5° C. and — 7·2° C. and to the strawberry hybrids 874, 1512 and 1804 which have outyielded the standard variety Mysovka [Bay].

3517 Kiričenko, F. G.
(**The principal results of work at the T.D. Lysenko All-Union Institute of Breeding and Genetics**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 23–28. [Russian].

This review of achievements in the last ten years deals with Mičurinist breeding methods and mentions new varieties of crop plants. Most of them have been in cultivation for some years; others are still under trial. The latter include wheats characterized by winter hardiness, resistance to drought and lodging and high quality grain, barleys with high yields and adapted to growing conditions in the steppe or

possessing good brewing properties, highly productive potatoes, a linseed which is more productive of oil than the standard variety for Odessa and heterotic hybrids of water melon with improved sugar and dry-matter contents obtained by crossing forage with dessert varieties.

3518 **(All these will be introduced in 1958 and 1959).**
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : 12–13. [Russian].

Recent varieties of agricultural and horticultural plants which are being introduced on farms in the south of the Odessa province are mentioned. In particular, reference is made to the lodging-resistant winter wheats Belaja Cerkov' 198 and Veselyj Podol 499, which are more productive than the standard variety Odessa 16, and to the egg plant Odessa 52, which is a high-yielding, early canning variety superior to older varieties.

3519 Oversikt over forsöksvirksomheten i jord- og plantekultur, vekståret 1957. **(Survey of experimental work on soil and crop cultivation, season 1957).**
Kontoret for Landbruksforskning, Oslo 1957 : Pp. 109. (Mimeographed).

Details of the layout of trials of varieties, strains and hybrid progenies of forage crops, cereals, pea, beet, swede and turnip are given. The material under study includes diploid and tetraploid red clover from a single chimera, apomictic strains from *Poa pratensis* x *P. ampla*, some promising radiation-induced barley mutants and interspecific crosses in wheat and oats. Among winter wheats, a number of lines appear to combine the stiff straw and good yield of Odin with medium earliness and consistent overwintering ability. Work on two-rowed barley has shown that, while it is possible to develop lines with stronger straw than any current commercial variety, it is less easy to obtain increases in yield. In smooth-awned six-rowed barley, lines combining these characters have been obtained.

Jord - Gröda - Djur. Aktuella praktiska resultat från svensk jordbruksforskning. Årsbok 1958. **(Soil—Crops—Animals. Current practical results in Swedish agricultural research. Yearbook 1958).** Pp. 336.

3520 *Bingefors, S. Förädling av vallväxter.* (*Breeding of herbage crops*). (*pp. 99–106*).

The following varieties suitable for cultivation in central Sweden are mentioned. The red clover U056, selected from the local variety Ultuna, is hardy and resistant to nematodes, while the tetraploid U036 (= Ulva) combines hardiness with resistance to both eelworm and clover rot [cf. XXVIII, 4336]. Hermes is a midlate red clover selected for hardiness from the southern Swedish variety Merkur. The tetraploid Alsike clover Tetra and a local white clover from Skultuna in Västmanland have given good results in central Sweden, as has the lucerne Tuna, a selection from French material. A local perennial ryegrass strain from Valinge is susceptible to rust but sufficiently hardy to be promising for breeding.

3521 *Nilsson, L. Ringröta hos potatis.* (*Ring rot in potato*). (*pp. 145–49*).

The varieties President, Friso, Teton, Merrimack, Saranac, Furore, Alpha and Elsa and selections from *Solanum tuberosum* x *S. demissum* are noted as being resistant.

Aktuella växtförädlingsproblem. **(Current breeding problems).**
Lantbruksveckan 1958 : 148–64.

3522 *Hagberg, A. Kromosomforskning i växtförädlingens tjänst.* (*Chromosome research in the service of plant breeding*). (*pp. 148–57*).

A popular survey of chromosome studies is presented, mention being made of the production of high-yielding tetraploid rye, turnip, beet and clovers in Sweden, the low fertility of some autotetraploids, the development of such allotetraploids as wheat-rye hybrids and synthetic rape and swede and the use of chromosome translocations in chromosome mapping and in breeding. At Svalöf, the technique of embryo culture has allowed interspecific crosses to be produced not only in *Brassica* but also in clovers and grasses. It is noted that although fertility is low in tetraploid rye, yield is good since up to a certain point kernel size is inversely proportional to fertility; this indicates that assimilation rate or distribution of assimilates rather than fertility is a limiting factor and it is suggested that an improvement in these characters may be effected by breeding.

3523 *Holmgren, O. Förädlingsresultat och förädlingsproblem för växtodlingen i sydöstra Sverige.* (*Breeding results and breeding problems for crop production in south-eastern Sweden*). (*pp. 157–64*).

In this review of breeding achievements and objectives at the Kalmar branch of the Swedish Seed Association the following results of cereal breeding are mentioned. A new winter wheat,

01607 (Hansa x Eroica), equals Hansa in yield on the light soils of the area but has greater straw strength. A cross of Kungsråg [King rye] with a Gotland variety shows promise and a winter barley with improved disease resistance has been developed. Oat varieties with von Lochows Gelbhafer [von Lochow's Yellow oat] in their pedigree, e.g. Örn [Eagle], Blenda, Sol [Sun] and Kalmar 01509, have shown resistance to damage by frit-fly larvae.

Svalöf Årsbok 1959. **Svalöf Yearbook, 1959.** Pp. 95.

3524 *Tedin, O. Betydelsen av nya eliter.* (*The importance of new élites*). (*pp. 8–12*).

The methods used at Svalöf, Sweden, in selecting new élites for the maintenance of varietal characters in cross-breeding crops are outlined with reference to rye and red clover. In Kungsråg II [King II rye], selection is made in alternate years for short strong straw, some of the grains from the selected plants being sown immediately and the rest retained. In the following year, the seed of the best mother plants, selected on the basis of progeny performance, is sown and from these the best are again selected and raised in an isolation field to give élite seed.

In maintaining the clover Merkur, selection for resistance to clover rot and nematode is made in second-year leys in severely infected plots.

In self-pollinating crops, maintenance is effected by roguing the deviating plants in different progenies and combining the remainder.

3525 *Nuet och i framtiden.* (*The present and the future*). (*pp. 13–37*).

A general outline of the breeding programme and current objectives for cereals, grasses, legumes, root crops, potato and other crops at Svalöf and its branch stations is presented [cf. XXVIII, 119 and 1269, and XXIX, 165]. The following breeding results are mentioned.

**Wheat.** At Kalmar, crosses of the German variety Isaria have given some good progenies.

**Rye.** Six lines have been obtained from the induced tetraploid Dubbelstål [Double Steel] and are being intercrossed.

**Barley.** In breeding winter barley, improvements in hardiness have been obtained in crosses between spring and winter forms.

**Clover.** The new white clover Kivi [Kiwi] has been released [cf. 3530].

**Rape.** The development of new swede rapes from crosses of turnip rape with cabbage has led to the production of some winter-hardy forms.

3526 *Fröier, K. Kommande nyhet i särklass.* (*A coming novelty in a class of its own*). (*pp. 51–55*).

The new barley Pallas, an X-ray induced mutant of Bonus previously referred to as *erectoides* 32 or Sv04032 [cf. 165], exceeds the parent variety in straw strength, responds better to high levels of nitrogen fertilizer, has shorter ears and slightly longer grains, ripens a little later but resembles Bonus in its high yield and other characters.

3527 *Andersson, G. Ny elit av Svalöfs Matadorraps.* (*New élite of the Svalöf swede rape Matador*). (*pp. 56–58*).

The new élite E of Matador has outyielded the earlier élite C by 6–9% in two years' trials; in other characteristics it resembles the parent variety.

3528 *Bingefors, S. Svalöfs Tuna-lusern.* (*The Svalöf lucerne Tuna*). (*pp. 65–67*).

This variety, developed at the Ultuna branch of the Swedish Seed Association from du Puits, shows good winter hardiness and in central Sweden it exceeds the parent variety in yield of green matter in each year except the first and surpasses Grimm every year. In southern Sweden it compares less well with other varieties.

3529 *Waller, E. & Halling, S. Svalöfs Hermes rödklöver.* (*The Svalöf red clover Hermes*). (*pp. 68–71*).

Hermes, selected from Merkur at the Västgöta branch station of the Swedish Seed Association, has shown high resistance to clover rot and nematode and has outyielded other midlate diploid varieties in Götaland, particularly in the second year. Its overwintering ability is good.

3530 *Åkerberg, E. & Halling, S. Svalöfs Kivi vitklöver.* (*The Svalöf white clover Kivi*). (*pp. 72–75*).

In tests at Svalöf, Kivi, selected from a New Zealand strain and previously known as Sv 0414 [cf. XXVIII, 119], has given high yields, particularly in summer and autumn, and has shown good persistence in older leys. The leaves and inflorescences are large and runner formation is rapid.

3531 *Josefsson, A. Svalöfs Fenix Bangholm stam 035 en ny torrämnerik kålrot.* (*Svalöfs Fenix Bangholm strain 035, a new swede with a high dry-matter content*). (*pp. 76–77*).

The strain, developed from a cross between the Bangholm strains 05 and 026, has yielded more dry matter than other Bangholm strains and other swede types in the Swedish Seed Association's trials and in national trials. The roots

are nearly spherical and keeping quality equals that of older varieties.

3532 Weibull, G.
Rättsskydd för växtförädlingen. (**Protection of rights for plant breeding**).
Agri hort. genet., Landskrona 1959 : **17** : 96–101.

After an account of the costs of plant breeding and of the contributions made to agriculture in Sweden and other countries by crop varieties bred at Weibullsholm, suggestions are made regarding the establishment of breeders' rights in Sweden.

3533 Holme Hansen, H. H.
Lokale forsøg og andre planteavlsarbejder. (**Local trials and other crop production work**).
Beretn. Planteavl. Loll.-Falster 1958 : 18–139.

The work described includes varietal trials of wheat, oats, barley and lucerne tested at various localities in Lolland and Falster, Denmark.

3534 Vestergaard, E.
Abed Planteavlsstation. (**Abed Plant Breeding Station**).
Beretn. Planteavl. Loll.-Falster 1958 : 5–17.

In addition to the work described below, results of varietal trials of wheat and early red clover are presented.

**Wheat.** Abed 51, from a cross between a Russian mildew-resistant form tested in Norway for many years and Joncquois, is not very uniform but has continued to give very good yields. Two lines from Weihenstephan I have proved hardy. Crosses under study include Cappelle x Weihenstephan I and the reciprocal and Hunsballe x Weihenstephan I. All lines of the New Zealand variety Dreadnought, which is regarded as resistant in its own country, have been attacked by mildew.

**Oats.** The Aberystwyth variety 01747107 remained unattacked by mildew throughout the growth period although all other varieties were attacked. Breeding for lower husk percentage has been initiated, using the thin-husked Netherlands variety Major. Selections of Palu and Max with very stiff straw have been made.

**Barley.** A population of Minerva x Abed 7-95 has done well and lines from it are to be used as parents. Outstanding resistance to leaf diseases has been found in *Hordeum laevigatum*, introduced from the Netherlands but originating from Japan; this species has been used in crosses with Abed 3371 and Abed 3173. Abed 6–87 (Piroline x Strengs III) and Abed 6–149 and 6–153, both from Carlsberg x Strengs III, have shown promise in preliminary trials. Productivity and good resistance to diseases appear to be combined in Hafnia x Minerva, Hafnia x Heine Fr. IX and Hafnia x *H. laevigatum*.

3535 Thøgersen, O.
Beretning om landboforeningernes virksomhed for planteavlen på Sjælland 1958. (**Report on the crop production work of the agricultural associations in Sjælland, 1958**). 1959 : Pp. 278.

Details are given of experimental work conducted in Sjælland, Denmark, in 1958, including varietal trials of wheat, oats, rye, barley and potato.

3536 58. beretning om planteavlsarbejdet i landboforeningerne i Jylland. (**58th report on the crop production work of the agricultural associations in Jutland**). 1958 (1959) : Pp. 700.

The results of field experiments carried out by local agricultural associations are reported, and include results of varietal trials of wheat, oats, rye, barley and potato.

3537 Árni Jónsson.
Skýrslur tilraunastöðvanna 1955–1956. (**Reports of the experimental stations, 1955–1956**).
Rit Landbúnaðardeildar : Ser. A. : 1958 : No. 12 : Pp. 119.

This report is concerned largely with fertilizer trials of different crops at various stations in Iceland but includes data on the results of yield trials of varieties of grasses, swede, potato, barley, oats and clover.

3538 4e jaarverslag. Proefstation voor de groenteteelt in de volle grond in Nederland. (**Fourth annual report. Experimental station for outdoor vegetable growing in the Netherlands**).
Alkmaar 1958 : Pp. 95.

In addition to the work described below, varietal trials of cabbages, strawberry, cucumber, celeriac, beetroot, lettuce, leek, spinach and broad bean have been held.

**Potato.** About one half of the crosses effected in 1957 show resistance to blight and root eelworm. Selection for cold resistance has begun. Various combinations of resistance to wart, blight and eelworm have been found in some third-year clones.

**Asparagus.** Crosses between Mary Washington and Beeren (a selection from Roem van

Brunswijk [Brunswick Glory]) have been effected and are being compared with parental and other material.

**Brussels sprouts.** A strong maternal influence was observed in open-pollinated progenies. Progenies of inbred lines generally showed inbreeding depression but occasional inbreds were better in growth and quality than open-pollinated material. Crosses between inbreds were particularly good in combinations involving Dublin strains.

***Phaseolus.*** Selection for resistance to anthracnose and virus diseases and for desirable plant characters has been carried out in populations of *Ph. vulgaris* x *Ph. dumosus*. *Ph. dumosus* is a short-day plant and partly transmits this character to its progeny; its crosses with *Ph. vulgaris* 'Combine', 'Prelude' and 'Romore' all flower throughout the summer when sown in January but when sown in March the two latter flower less abundantly and the first not at all. Combine x *Ph. dumosus* and Romore x *Ph. dumosus* have been crossed with climbing and dwarf French beans. *Ph. coccineus* 'Emergo' has been crossed with climbing and dwarf, slicing and snapbean types of *Ph. vulgaris*; the crosses involving dwarf beans were hardly viable.

**Pea.** Among breeding lines tested, a yellow pea from Aureool [Aureole] x Eroïca, having a white hilum and resembling Aureool in quality, and a dun pea from Rondo x Koroza, similar to Rondo in growth type and having small attractive yellow seeds, have been retained.

3539 DE HAAN, H.
Terugkruising wordt toegepast in verschillende veredelings programma's.
(**Back crossing is applied in various breeding programmes**).
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1959 : **15** : p. 128.

The use of the back-crossing technique in transferring resistance to blight and eelworm from *Solanum andigenum* to *Solanum tuberosum* and rust resistance from resistant flax varieties to Wiera is briefly mentioned.

3540 Het wetenschappelijk onderzoek in de landbouw. Periode 1947–1956. Deel I.
(**Scientific research in agriculture. 1947–1956 : Part I.**)
Minist. Landb., Brussel 1957 : Pp. 290.

In addition to the breeding results referred to below, it is reported that testing of maize hybrids is in progress and that breeding of grasses, clovers, mangels and rape is under way. The work on grasses and clovers includes the induction of polyploidy.

**Wheat.** The work leading to the production of Fylby and Phoebus is outlined [cf. XXVI, 3152].

**Oats.** Three new varieties, all with stiffer straw than Flämingsgold and all giving good yields, were entered in the Belgian varietal list in 1952 and 1953. Their names are Zeegold [Sea Gold], from Moorgold x Zege [Victory], Argo, from Zenith x Flämingsgold, and Medea, from Zenith x Viennauer.

**Rye.** The following genotypes for different types of pigmentation are put forward: *ab* and *aB* for the normal phenotype with yellow grains and colourless nodes, glumes and awns; $A_1a_2b$, giving pink seedlings and a slight coloration of the spikelets, glumes and awns; $A_1A_2b$, determining red coloration of all the above parts except the grain; and $A_1A_2B$, similar to the previous type but with green grain. The factor *B* appears to be cryptomeric. Crosses between plants with a waxy bloom on the ears and those without gave an $F_2$ in which some individuals had pruinose stems and leaves as well as ears. It is thought that a cryptomeric factor is present in some nonpruinose plants. Tough *versus* brittle stem is dominant and monogenically determined. Three series of multiple alleles controlling chlorophyll production have been investigated [cf. XXVII, 1505]. The *variegata* character is cytoplasmically inherited. The progeny of crosses between a long-strawed form and a homozygous short-strawed form failed to give simple segregation ratios and it is believed that straw length is also cytoplasmically determined.

A new variety, Celestijnerrogge [Celestine rye], has been developed from the combination of clones from the artificial crosses Koningsrogge [King rye] x Korte Vlaamse [Short Flemish] and Brandt's Mariën x Waregemse and the spontaneous crosses of Koningsrogge and Brandt's Mariën with these hybrids. During the course of breeding, clonal lines were developed by dividing the best plants in the various families and these were then allowed to interpollinate. Compared with the clonal lines, Celestijner shows some heterosis in yield. It compares favourably with Petkus in both straw length and yield.

**Turnip.** Two new varieties, Waaslander RVP and Meetjeslander RVP, both similar to good land races in yield but showing high resistance to club root, have been produced.

**Potato.** Root-eelworm resistant material selected from *Solanum andigenum, S. sucrense* and

*S. yabari* has been crossed with the potato varieties Furore and Forto; 372 resistant individuals were selected from the $F_1$.

**Lettuce.** Mention is made of the new variety Hilde (Vroege van Heverlee [Heverlee Early] x Blonde de Chatelet), which tolerates heat and transport well and has large heads free from anthocyanin.

**Chicory.** A new variety named Novipa has been developed by selection from Palingkop. It has long cylindrical roots with high contents of dry matter and inulin, is early in maturity and good in roasting quality and resists bolting.

**Tomato.** The hybrid Ronald is resistant to corky root.

**Pea.** Two recent varieties are described. Vroege van Heverlee [Heverlee Early], from Mechelse Voorloper [Mechelse Forerunner] x Unica, is early and high in yield with straight full pods with greenish blue seeds. Joserva (Mansholt x Unica) is particularly good in canning quality.

3541 Larose, E.
La Station de Recherches de l'État, pour l'Amélioration des Plantes de Grande Culture à Gembloux. **(The State Research Station for the Improvement of Crop Plants at Gembloux).**
Rev. Agric., Brux. 1958 : **11** : 1389–94.

A review of plant breeding at Gembloux from 1913 onwards is given. In particular, mention is made of improvements in wheat, spelt, oats, barley, leguminous forage plants, flax and tobacco.

3542 Salzmann, R.
Tätigkeitsbericht der Eidg. Landwirtschaftlichen Versuchsanstalt Zürich-Oerlikon über das Jahr 1957. **(Report on the work of the Federal Agricultural Research Station, Zürich-Oerlikon, for the year 1957).**
Landw. Jb. Schweiz 1958 : **7** : 575–650.

Brief details of breeding work on cereals and forage plants are presented. In wheat breeding special attention is being given to improving resistance to rusts, dwarf bunt and *Septoria*.

3543 **(New varieties in 1958).**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : p. 214, 276. [Japanese].

In addition to the varieties listed below, mention is made of the new mint variety Hakubi (=Norin **3** [Ministry of Agriculture and Forestry **3**] and the new *Boehmeria* varieties Shiraginu (=Norin 1) and Aokaze (= Norin 2) but no descriptions are given.

**Barley.** Shirahimehadaka [Shirahime Naked] (= Norin 17), from Ehimehadaka 2 (Ehime Naked 2) x Akashinriki [Red Supernatural Strength], is a high-quality naked barley with agronomic characters approximating to those of Akashinriki. Hayajirohadaka [Hayajiro Naked] (= Norin 18), from Hakubaku 8 [White barley 8] x Sagahadaka 1 [Saga Naked 1], is a strong-strawed early naked variety resistant to lodging. Sunaji [Sandy Soil] (= Norin 11), from 83 x Aizu 4, is an early six-rowed variety with yellowish white grains; it is especially recommended for sandy areas. Hotei (= Norin 12), from 34 x 24, is a midseason six-rowed variety with yellowish-white grains recommended for intercropping with vegetables.

**Maize.** Hybrid 4 (= Norin 7 three-way hybrid) is a productive three-way hybrid recommended for northern Japan.

**Potato.** Yoraku [Necklace] (= Norin 7*) from 41089–8 x Norin 1, is a late variety with a high starch content (ca. 20%).

**Rape.** Miyuki (= Norin 28), from Michinoku x Washu 1, is a very early, cold-resistant variety with an oil content of 42·4% of the dry matter. Mikawa (= Norin 29), from Tokai 1 x Kinki 32, is a strong-stemmed early variety with an oil content of 42·9%.

**Soya bean.** Hokkaihadaka [Northern Sea Naked] (= Norin 14), from Togachichoyo [Togachi Long-leaved] x Chaseihadaka [Midseason Naked] is a small-seeded variety of the naked-seeded type; it matures in midseason. Fukumejiro (= Norin 15) from Hanayomeibaraki 1 x Sokyo, is a productive midseason variety. Koganedaizu [Golden soya bean] (= Norin 16), from New 3 x Matsuura, is a midseason variety with high yield and superior quality.

3544 Rapport Annuel pour l'exercice 1957. **(Annual Report for the financial year 1957).**
Publ. Inst. nat. agron. Congo belge 1959 : Pp. 529.

In addition to the results summarized below, breeding of cereals, forage grasses, potato, sweet potato, yam, tea, tobacco, *Pyrethrum*, fruits and other minor crops is briefly reported.

**Rice.** The total chromosome length of five wild species is recorded and compared with that of *Oryza sativa*. Tetraploids of R66 obtained by colchicine treatment have shorter straw than

* The variety Tachibana has also been registered as Norin 7 [cf. XXVI, 2074].

that of the diploids, darker leaves and fewer but larger spikelets. Most of the tetraploid flowers produce no grains but those which are formed are larger and heavier than diploid grains. Cells, nuclei, stomata and pollen grains of the tetraploids are also larger than those of the diploids. Meiosis in the tetraploids is regular and pollen sterility is of the same order as that found in the diploids. It seems that the principal cause of tetraploid sterility is to be found in the development of the ovule after fertilization. Plants treated with colchicine also yielded some diploid mutants. It was found that a 0·1% colchicine solution applied to roots for 15 hr. is an efficient method for the induction of polyploidy, for most of the meristematic cells survive this treatment. A number of introduced varieties are the subject of genetical and cytological studies. Some crosses have also been effected with a view to increasing resistance to lodging and improving the vitreous appearance of the grain of the best lines at Yangambi. OS6 gave the best yield in the varietal trials.

**Grasses.** Plants of *Brachiaria brizantha* with $2n = 45$ and others with $2n = 36$ have been found. Eight morphologically different clones of *B. ruziziensis* had $2n = 18$.

**Leguminous crops.** The following chromosome counts were made: *Stylosanthes erecta*, $2n = 60$; *S. mucronata*, $2n = 40$ and 20; *S. bojeri*, $2n = 20$; *S. sundaica*, $2n = 20$; *Desmodium intortum*, $2n = 22$, *D. incinatum*,* $2n = 22$; *Crotalaria intermedia*, $2n = 16$; and *C. longithyrsa* var. *latifolia*, $2n = 16$. Artificial tetraploids of *C. goreensis* resembled diploids but had larger thicker leaves of a deeper colour; also the pollen and stomata were larger and less viable seed was produced.

**Cotton.** Data are provided on the principal characteristics of some lines selected at Bambesa. Eight families originating from crosses between different Stoneville types and Bar 7/8 and also a triple hybrid have shown good productivity and produced very long fibres. At Gandajika several lines originating from crosses of 1103 x Gar have shown promise and in particular NC2/2253 with its superior fibre length. Some ND lines have also given good results. A series of interspecific hybrids are under observation.

**Cassava.** Six tetraploid plants were obtained by colchicine treatment; the diameter of the tetraploid stomata is 33·5 $\mu$ and that of the diploids 24·6 $\mu$. The results of varietal trials are also given.

***Coffea.*** The diploid chromosome number of *C. klainii* was found to be 22 and that of *Psilanthopsis kapakata* 36. Very few differences were found in the genome morphology of various species of *Coffea*. Five tetraploid plants have been obtained by colchicine treatment. The stomata of diploid and tetraploid forms of *C. canephora* have diameters of 22·7 and 25·1 $\mu$ respectively. The chromosome number of *C. arabica* x *C. eugenioides* was found to be $2n = 34$; meiotic abnormalities typical of interspecific hybrids were observed. It was found that 31·8% of the pollen of this hybrid was empty and the normal grains varied considerably in size. Studies are under way with a number of interspecific crosses and also some intraspecific crosses have been effected. Several clones have given high yields in the trials at Yangambi; information is provided on the yields obtained from a number of lines.

**Cacao.** Observations on the development of normal fertilized ovules are recorded. No evidence has been found supporting the idea that incompatible flowers contain a substance in the style inhibiting pollen germination. Self incompatible clones were classified according to their degree of incompatibility, this being determined by observations made on the development of the ovules. It was then found that, with regard to the percentage of fruit set and of fruit fully developed, there was very little difference between clones varying in the cytological manifestation of sterility. All crosses possible have been effected between three Forastero clones and two other hybrid clones. Information is provided on the performance of clones and seedlings of Forastero mother trees and various hybrids.

**Oil palm.** *Elaeis madagascariensis* was found to have a diploid chromosome number of 32. Observations continued on a large number of lines produced by selfing or hybridization; data are provided on the performance of some of these lines. It was confirmed that the *albescens* character is controlled by a single factor.

**Rubber.** Meiosis in *Hevea spruceana*, *H. collina*, *H. guyanensis*, *H. brasiliensis* and *H. benthamiana* has been found to be regular and similar in all five species. They all have 36 chromosomes and are thought to be of ancient tetraploid origin. In the trials in Yangambi, the new clone 593/4 originating from the mother plant Tj1 produced a yield 187% of that of the standard variety V18. The clones 230/22, 215/22, 226/29 and 147/27, which have also

*? *D. uncinatum*.

outyielded M8, are resistant to breaking and the bark regenerates well. On quite heavy soils, Y3/46 has proved superior to a number of other varieties. Data are also provided on the general performance of some other legitimate and illegitimate progenies.

**Groundnut.** The diploid chromosome number of *Arachis glabrata* was found to be 40. The results of varietal trials are reported.

**Banana.** Crosses were effected between edible and seeded bananas and between *Musa acuminata* and *M. ornata*; also some back crosses were made. The back cross of Km5 x *M. acuminata* to *M. acuminata* was found to be diploid and the plants investigated have shown no parthenocarpy. Measurements were made of the pollen size of a series of diploids and tetraploids and the coefficients of variation are recorded. *M. acuminata* 'Rouge' [Red], which has a high coefficient of variation, appears to be a hybrid. Km5 x *M. acuminata* 'KDI' has a low coefficient of variation; on back crossing with *M. acuminata* many seeds are produced which germinate easily and yield diploid plants closely resembling types with seeds. The genomes of *M. ornata* and *M. acuminata* do not appear to be closely related. Tetraploid hybrids of Mayumbe x *M. acuminata* showed numerous meiotic abnormalities.

**Bean.** Measurements are recorded of the total length of somatic chromosomes in six species of *Phaseolus*.

**Soya bean.** At Yangambi seventeen $F_7$ hybrids have attained a normal level of homogeneity; they are characterized by a vegetative period of 95 days, good resistance to lodging and most of them have light-coloured seeds. Trials of midlate and early varieties were carried out and 28 of the former and 23 of the latter were retained. Of the midlate types S46 gave the best yield of dry seeds and SH162 was the best early variety.

**Annual Report of the East African Agriculture and Forestry Research Organization for the period 1st July, 1956 to 31st December, 1957.** Pp. 112.

3545 *Doughty, L. R., Gourlay, D. W. & Jennings, D. L. Cassava.* (*pp. 43–44*).
Ceara x cassava back crosses and their intercrosses appear to be producing clones which combine high yield with resistance to both mosaic and brown streak. Crosses between derivatives from line 4032, a first back cross of ceara x cassava to cassava, have produced the most successful clones so far.

3546 *Jennings, D. L. Studies on the mosaic virus of cassava.* (*pp. 44–46*).
Symptomless plants can be carriers of the mosaic virus and the only means of recognizing the presence of the virus is by plucking tips from growing branches or pruning such branches, which may result in the appearance of symptoms in the young leaves of the plant. Resistance appears to be, at least in part, an ability to move the virus rapidly to parts of the plant where it can do no harm. Among the latest hybrids raised, there are a few clones that have remained free from symptoms under the most severe conditions but it is not known if this field immunity will be maintained through the period of multiplication in a region where the disease is severe.

3547 *Doughty, L. R. & Graham, T. Application of the Brieger method to maize breeding.* (*pp. 46–48*).
Three types of maize, from the Nyanza Province of Kenya, the Lake Province and coastal area of Tanganyika, are being used for the production of self-maintaining lines of synthetic maize. So far only a few $S_3$ top crosses have exceeded the mean yield in the trials by a significant margin.

3548 *Jennings, D. L. Sorghum.* (*pp. 48–49*).
Breeding for varieties resistant to *Striga hermonthica* and *S. asiatica* has established that Dobbs possesses good resistance to *S. hermonthica*. Breeding to transfer good-quality grain to this variety has reached an advanced stage. Dobbs is also resistant to shoot fly (*Antherigona indica*). Field experiments have been set up to assess the smut (*Sphacelotheca sorghi*) resistance of some sorghum material.

3549 *Storey, H. H. & Howland, A. K. The American rust disease of maize caused by* Puccinia polysora *Underw.* (*pp. 49–51*).
Further work on the genetics of resistance of *P. polysora* has been carried out [cf. XXIX, 348]. The genes for resistance, $Rpp_1$ and $Rpp_2$, are linked and crossing over is expressed in about 12% of the gametes. The combination of both genes in the pure state in a single family has been achieved by selecting and breeding from cross-over types. However, field breeding to transfer both genes together into any chosen maize varieties involves many practical difficulties. There is evidence that a third gene exists in certain lines from North America, which only confers very moderate resistance against races EA.1 and EA.2.

3550 *Storey, H. H. & Howland, A. K. The genetics of resistance in maize to the virus of streak disease* (*pp. 51–52*).

A beginning has been made in testing maize lines from a Peruvian Yellow variety for resistance to streak.

3551 **Report and accounts of the Tanganyika Agricultural Corporation for 1956–1957.** Pp. 137.

**Maize.** The programme designed to introduce resistance to *Polyspora* rust and to eliminate undesirable characters in the standard local variety Katambili has been completed.

**Sorghum.** Selections from Swaziland x Ukiriguru were bulked for issue until a more suitable variety with better grain quality can be produced from Msumbiji x BC 27.

**Sesame.** The nonshattering varieties Rio and Palmetto have been found to be unsuited to local conditions. Five shattering varieties from Venezuela showed promise.

**Sunflower.** Selection has led to "a more uniform strain, white seed colour, uniform height and a reduction in the proportion of multiple headed plants".

**Soya bean.** MIS 2 x R184 has produced material with the useful characters of determinate or semideterminate growth combined with high yield, the required height of the first branch above ground level, and time from sowing to maturity ranging from 107 to 121 days. A straight selection from Hernon 237 also shows promise.

3552 **Annual Report of the Field Husbandry and Chemistry Sections of the College of Agriculture and Experiment Station, Potchefstroom. 1953–1954** : Pp. 120. (Mimeographed).

Projekteverslae van die Landboukollege en Proefplaas, Potchefstroom. 1956–57. (**Project reports of the College of Agriculture and Experiment Station, Potchefstroom. 1956–57**) : Pp. 182. (Mimeographed).

**Project Report of the Field Husbandry and Soil Science Sections of the College of Agriculture and Experiment Station, Potchefstroom. 1957–1958** : Pp. 163. (Mimeographed).

In addition to the work referred to below, trials of varieties and breeding lines of oats, castor oil plant, linseed, sunflower, tomato and cowpea have been conducted. Brief notes on the breeding aims for each of these crops and for lucerne are given. Results of tests of numerous wheats for resistance to stem and leaf rusts, of maize varieties for resistance to *Sorosporium reilianum, Trichometasphaeria turcica* and stalk borer and of groundnut varieties for *Cercospora* resistance are reported.

**Wheat.** Plants resistant to stem rust were obtained among *Triticum timopheevi* derivatives. $F_1$ plants of Sputnik (45W3–24) x Gabo were all dwarfs, as were most back crosses to Gabo. Elongated spikelets occurred in the ears of [(White Spitskop x *T. timopheevi*) x Penkop] x Gabo, [(Red Spitskop x *T. timopheevi*) x Penkop]$^2$ and (Wol [Wool] x *T. timopheevi*)$^3$.

**Maize.** Tabulated data are presented on the performance of numerous varieties, inbred lines and single, double and top crosses of dents, flints, sweet corn and popcorn. Experiments with cytoplasmically male-sterile lines have given promising results. The popcorn hybrid (SG18 x SG30A) SA24 has done well in trials and is being produced commercially.

**Sorghum.** Crosses involving a cytoplasmically male-sterile line have been effected.

**Groundnut.** Numerous crosses have been effected, involving P4402 and P4403, resistant to rosette, and P4137 and P4138, resistant to *Cercospora*.

Recherches agronomiques. Sommaire des résultats 1948–1957. Le Conseil des Recherches Agricoles. (**Agronomic research. Summary of results 1948–1957. Agricultural Research Council**).
Québec 1958 : No. 2 : Pp. 51.

3553 *Vézina, C. Hétérokaryose chez les aspergilles.* (*Heterocaryosis in* Aspergillus). (*p. 9*).

Ultraviolet irradiation of *A. fonsecaeus* yielded 11 mutants differing from the wild type in colour, growth rate and certain biochemical characters. These mutants produce heterocaryons resembling the mother stock. Certain combinations of mutants produce structures identical with those of heterocaryons but contain only one type of nucleus.

3554 *Chevrette, J.-E. & Dessureaux, L. Collection de plants de luzerne tolérant aux sols acides.* (*The collection of lucerne plants tolerant of acid soils*). (*pp. 17–18*).

In Quebec, plants were collected from soils ranging in pH from 6·7 to 5·2; marked variation was found in tolerance of soil acidity. It is considered worth while to breed for improved acid tolerance in order to obtain a variety suitable for eastern Canada; two promising stocks are already being used for this purpose.

3555 *Louis-Marie, R. P. Étude génétique du* Lotus corniculatus *L.* (*Lotier corniculé*). [*A genetic study of* L. corniculatus *L.* (*Birdsfoot trefoil*)]. (*p. 19*).

The variety Empire and others of similar American origin develop a red pigment at the base of the stem whilst in varieties of European origin such as Viking this region is white; the Empire type is designated *L. corniculatus* var. *rubrotinctus*. Both types include "hay" forms with erect stems and "pasture" forms with prostrate, more numerous stems; the latter are designated f. *prostratus*.

3556 *Steppler, H. A. A study of the use of induced tetraploidy in Dollard red clover* (*R.C.2*). (*p. 20*).

At Macdonald College, McGill University, several tetraploid lines have been studied with special reference to forage yield, seed yield and growth habit. It appears that by means of selection, the yields of forage and seed can be brought up to the diploid level but it is questionable whether forage yield can exceed that of the diploids. Further studies of the persistence and forage yield of the triploids are under way.

3557 *Steppler, H. A. Growth and development of red clover and genetic studies of inheritance of growth type* (*R.C.3*). (*pp. 20–21*).

Many different growth types have been noted which differ in ability to overwinter, in rate of recovery after cutting and in amount of bloom. Some need cold temperature treatment before they will flower while others do not. It appears that by selecting the correct growth type it will be possible to produce a persistent clover capable of surviving at least two winters. Recent studies in Quebec have been concerned with the genetics of growth type and flower and seed colour.

3558 *Baribeau, B. La production et la transformation des pommes de terre en "chips".* (*Production and transformation of potatoes into chips*). (*pp. 23–24*).

Of the 35 varieties tested for suitability for making crisps, some of the most promising were Irish Cobbler, Kennebec, Katahdin, Keswick and Sebago.

3559 *Campagna, E. Étude de la résistance de diverses variétés de pommes de terre* (*a*) *à la brûlure tardive,* (*b*) *à la gale commune,* (*c*) *aux maladies à virus.* (*A study of the resistance of different potato varieties* (*a*) *to late blight,* (*b*) *to scab,* (*c*) *to virus diseases*). (*pp. 41–42*).

In tests in Quebec, the varieties showing most resistance to *Phytophthora infestans* in 1951, 1952 and 1954 were Calrose, Arran Victory, Ontario, Sebago, Keswick, King Edward, Arran Consul, Rural Blush, Kennebec and Menominee; for these varieties the average percentage of infected tubers varied between 0·1 and 2·5%. Varieties resistant to *Streptomyces scabies* were Seneca, Pungo, Ontario, Netted Gem, Menominee, Early Gem, Cayuga, Huron, Plymouth and Cherokee and varieties most resistant to virus diseases were Kennebec, Saco, Sebago, Katahdin, Cherokee, Delus, Early Gem, Huron, Merrimack, Osage and Plymouth.

3560 Por los centros de investigación. (**At the research centres**).
Agric. téc. Méx. 1958–59 : No. 7 : 29–33.

Notes on the work of Mexican experimental stations are given. At the Agricultural Research Centre of the Northwest, Obregón, trials of sesame, lucerne, cotton, maize and sorghum are in progress. At Cotaxtla, Veracruz, crosses of the maize V–520C and various Tuxpeño lines with three cytoplasmically male-sterile forms, *viz.* one with vestigial glumes, one designated Reidi's source and one with the parentage ([(CME x Kys) Ba] x Bb) — 1 x Wf9L[2], show that V–520C carries genes restoring male fertility and that male sterility appears to be transferable to $T_2$. At the same station, tests of beans, rice and sesame are conducted. Chilli hybrids showing appreciable vigour and greater fruit production than their parents have been developed at El Horno, Chapingo. A useful maize hybrid, H–127, and a potato, Eréndira [cf. 2821], showing resistance to blight, have also been produced.

3561 Informe Anual 1957–1958. Instituto Interamericano de Ciencias Agrícolas Turrialba, Costa Rica. (**Annual report, 1957–1958. Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica**) : Pp. 48.

The work of the plant breeding department includes: irradiation of coffee, cacao, banana and other crops with the aim of inducing mutations; the collection of coffee varieties, including material resistant to *Hemileia*, and of varieties of *Oxalis tuberosa, Ullucus tuberosus* and other tuberous Andean species; the production of intervarietal crosses of maize, some of which have done as well as the best double-cross hybrids tested in Central America; and testing rice varieties for disease resistance.

3562 **Report of the Governing Body and the Principal's Report of the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, for 1957–58** (1959) : Pp. 63.

**Cacao.** Testing for resistance to witches' broom (*Marasmius perniciosus*) continued, present work being confined to the testing of "sib-crosses and to gamete testing among the Trinitario-Scavina hybrids." In addition, P12, a selection introduced from Peru in 1943 and reported to be resistant in other countries, was tested. It proved to be less resistant than SCA12 but superior to other clones. Differences in early growth of seedlings derived from various parents were noted during the course of the tests. A study of the genetics of growth has therefore been initiated. The Trinitario-Scavina hybrids continued to give high yields and received favourable reports as to flavour, which was considered to be of the Trinitario type. Crosses were made between Scavina and Grenada selections to provide material for study in Grenada. The early results from the first experiment involving $S_1$ crosses were encouraging. At River Estate, the wilt condition associated with the "*Ceratostomella-Xyleborus* complex" was severe, the trees most susceptible being those of Criollo parentage. As most of the breeding stock is of this derivation, resistant types need to be added.

"Analyses have been made of the effects of incompatibility/compatibility factors on the proportions of genotypes present in populations in equilibrium. Where self-compatible trees are absent, a population is able always to attain an equilibrium position—in the sense that in successive generations of random breeding the genotype proportions are unaltered. The bottom-recessive homozygote is always the most abundantly represented genotype and the bottom-recessive allele predominates in the population. Recessivity always enjoys selective advantage. Where self-compatible types are present in a population, with self-incompatible types, no equilibrium is possible. In an isolated cacao population, self-compatible and self-incompatible genotypes cannot co-exist indefinitely; in successive generations, the self-compatible type gradually eliminates the self-incompatible, so that the population, if no new *S*-alleles are introduced, eventually becomes all self-compatible. The selective advantage of recessivity is here so great that active *S*-alleles are completely displaced by the amorphic $S_f$. Analyses reveal, further, that if allowance is made for selfing on the self-compatible tree, the population can contain, for a length of time, only $S_{a \cdot f}$ and $S_{f \cdot f}$ trees, where $S_a$ is the bottom-recessive active *S*-allele present in the population before the $S_f$ amorph was introduced. $S_{a.f}$ genotypes are self-incompatible and cross-incompatible (because of the common $S_a$ allele), so that self-incompatible selections made in a population which has evolved to this stage will also be cross-incompatible. The Trinidad population must be closely approaching this condition for no self-incompatible ICS clones have yet been found which are cross-compatible. If selection work is carried out in populations which contain self-compatible and self-incompatible types, it will obviously be necessary to avoid planting derived self-incompatible clones singly or in mixtures."

Study of the inheritance of pigmentation and the condition "crinkled dwarf" continued. The following new crosses were effected: *Theobroma angustifolia* x *Th. mammosa*, *Th. subincana* x *Th. mammosa*, *Th. subincana* x *Th. nemorale* and *Th. subincana* x *Th. angustifolia*. Progress has been achieved in crossing within the genus *Herrania*, $F_2$ plants having been obtained from some of the older crosses.

**Banana.** The situation in breeding ♂ parents is briefly reviewed. Markedly improved types have developed, largely as the result of the acquisition of new diploid stocks from Africa and the East and their use in crosses. The promise of seedlings resulting from the crosses is however subject to tests of disease resistance and actual performance as ♂ parents. Further cytological investigation of interspecific hybrids indicated only a low degree of differentiation between members of sect. *Australimusa* ($n$=10). Two new species have chromosome numbers hitherto unrecorded in the genus *Musa*. A recent accession from Borneo is, in appearance, related to the 20-chromosome bananas of sect. *Callimusa*, but has a $2n$ number of 18 and thus a basic number ($x = 9$) previously known only in *Ensete*. A gigantic wild banana from the mountains of New Guinea has $x = 7$, a basic number hitherto recorded only in one species of *Strelitzia* in the entire order Scitamineae.

**Other crops.** Selection of *Cajanus cajan*, with the initial aim of dwarf, early-maturing strains, is under way. Cultivars of *Dioscorea alata* are being selected on the basis of shallow-growing tubers with an even shape suitable for mechanical harvesting. Cultivars of sweet potatoes, *Xanthosoma* and *Colocasia* were also studied. Information is given on improvement programmes initiated on various crops elsewhere in the Caribbean area [cf. XXVIII, 3946].

3563 **Report of the Department of Agriculture, New Zealand, for the year ended 31st March, 1958** : Pp. 161.

Variety trials of wheat, oats, barley, lucerne, and various vegetables and fruits are reported.

**Application of atomic science in agriculture and food. Vol. II. Present position, future trends and techniques.**
OEEC, Paris 1958 : Project No. 396 : Pp. 247.

The report of the above conference includes the following paper:—

3564 *Gustafsson, A. Developments of methods and principles of plant breeding resulting from the application of atomic science. (pp. 85–88).*

For the benefit of the nongeneticist, a short review is given of the methods, achievements and further possibilities of improving crop plants by means of induced mutation.

3565 Voisin, J. C.
Leçons d'amélioration des plantes à l'usage des élèves des écoles d'agriculture nantis du certificat ou du brevet d'études primaires. **(Plant breeding lessons for the use of pupils possessing the primary studies certificate or diploma at agricultural schools).**
Imp. du Gouvernement, Cameroun Undated : Pp. 47.

In this series of elementary lessons, sexual and vegetative reproduction, the origin and morphological and physiological characteristics of some cultivated plants and the association of these characters are briefly described. Finally, mention is made of simple methods of variety trials and selection.

3566 Nováková, Z.
Prof. Dr. František Frimmel mrtev. **(Prof. Dr. František Frimmel has died).**
Preslia 1958 : **30** : 337–40.

A short account is provided of the life and work of F. Frimmel and his breeding work with many important plants.

3567 Wolski, T.
Ważniejsze problemy związane z metodą ogólnego zapylenia w hodowli jednorocznych i dwuletnich roślin obcopylnych. **(The main problems concerning the method of general pollination in breeding annual and biennial cross-pollinated plants).**
Postępy Nauk Roln. 1957 : **4** : 3–13.

Compared with breeding methods involving heterosis, the method of general pollination, which involves open pollination among numerous strains and varieties, is slow but obviates inbreeding depression and is thus more suitable for such crops as rye, which have a low coefficient of reproduction. In addition, the method allows the retention of wide genetic variation and of a greater number of desirable genes.

3568 Konvička, O.
Přegląd metod i urządzeń izolacyjnych, stosowanych w hodowli roślin. **(A review of isolation methods and apparatus used in plant breeding).**
Postępy Nauk Roln. 1957 : **4** : 125–32.

Types of bags and isolation chambers used in breeding different crops are surveyed.

3569 **(A meeting on distant hybridization of plants and animals).**
Bjull. Glavnogo Bot. Sada (Bull. Princ. Bot. Gdn.), Moskva-Leningrad 1958 : No. **31** : 126–29. [Russian].

At the opening session of a meeting that took place on 5–8 Feb. 1958, N. V. Cicin stressed the importance of distant hybridization as an element of Mičurinism and cited the success of the experiments with *Triticum* x *Agropyron* crosses [cf. 2410–26]. Many speakers cited the success of distant hybridization in breeding vegetables, fruits, ornamentals and forest trees. V. A. Rybin and others referred to the importance of polyploidy, Rybin mentioning in particular his artificial synthesis of the domestic plum.

G. D. Lapčenko described some hybrids of the wheat type obtained by crossing $F_2$–$F_3$ hybrids of *Triticum* x *Agropyron* with rye, the hybrids being winter hardy and high in yield, their ears bearing 30–32 spikelets and up to 180 grains. Several other speakers described promising *Triticum* x *Agropyron* hybrids that have been released, some of them commenting on the high quality of their grain. Other hybrids referred to were wheat x *Elymus*, sorghum x Sudan grass giving over 800 c. of forage per ha. under irrigation and a good hard wheat produced from *T. turgidum* x *T. dicoccum*. A giant sorghum yielding up to 1500 c. of forage per ha. under irrigation was produced from *Sorghum cernuum* x *S. technicum*.

Valuable disease-resistant potatoes involving three and four species were described by S. M. Bukasov, complex tobacco hybrids involving wild *Nicotiana* spp. by M. F. Ternovskij and sugar beets obtained from crossing with wild beet by V. I. Zosimovič. Hybrids of sunflower

x Jerusalem artichoke were reported by I. I. Marčenko to have yielded 600–700 c. per ha. of green fodder and 150–200 c. of tubers.
A number of other speakers referred to wide crosses in domestic animals and fishes.

3570 Gaul, H.
**Present aspects of induced mutations in plant breeding.**
Euphytica, Wageningen 1958 : **7** : 275–89.

Methods of improving the efficiency of mutation production and selection are reviewed. Control of mutation frequency may be effected by (*a*) increasing the total mutation frequency per surviving $M_1$ plant by treatments which allow greater survival, (*b*) altering the relative frequencies of chromosome mutations by appropriate treatments according to the type of mutation required, and (*c*) changing the mutation spectrum through the use of suitable mutagens. For the control of selection, it is suggested first that diplontic selection may be eliminated to a large extent if irradiation is applied only to primordia having only one or very few initial cells forming the tissue in which mutation is required. Secondly, selection of mutants may be effected in the $M_1$, barley being given as an example in which, since completely fertile $M_1$ spikes possess the same frequency of point mutations as partially sterile spikes, selection of the fertile spikes should lead to the elimination of a large number of undesirable chromosome mutations. The need for improved methods of screening for small mutations in later generations is pointed out.

3571 Tallarico, G.
Il giardino degli atomi. (**The garden of the atoms**).
Agricoltura, Roma 1959 : **8** : 55–59.

An account is given of the gamma field at the Brookhaven National Laboratory, New York, and of some of the useful mutations obtained.

3572 **Radiation induced mutation.**
Rur. Res. CSIRO 1959 : No. 27 : 2–5.

An account is given of projects on the introduction of useful mutations in crops in Australia. At the CSIRO Division of Plant Industry, Canberra, tobacco mutants resistant to blue mould and tomato mutants resistant to nematodes have been secured. In the case of the latter, the particular radiations used, ultraviolet light and X rays, have apparently affected several genes in addition to those controlling nematode resistance. Reselection or back crossing to the original commercial variety is therefore necessary. Attempts are also being made to develop grape stocks resistant to root-knot nematode, awnless barleys and early-flowering varieties of subterranean clover which retain the leafiness of the later type. Other work at Canberra is directed towards the induction of mutations in legumes which would break down the incompatibilities of certain clovers and *Medicago* spp. with rhizobial strains commonly present in the soil and which would promote symbiosis in species tending to be generally deficient in the capacity for this relationship. At the Plant and Soils Laboratory, Brisbane, radiation is being applied to subtropical pasture plants. Some of the aims are nontoxic mutants of *Indigofera endecaphylla*, mutants of *Lotononis bainesii* resistant to little leaf, mutants of *Leucaena glauca* with little or no mimosine and greater variability in apomictic *Paspalum* spp. Use of X radiation at the Institute of Agriculture, University of N. Australia, has resulted in an early-flowering mutant of *Lupinus digitatus* of possible economic value. Mutants of subterranean clover are also under test for their practical possibilities.

3573 Njubom [Nybom], N.
(**Plant breeding with the aid of induced mutations**).
Agrobiologija (Agrobiology) 1958 : No. 5 : 15–28. [Russian].

This paper is the first part of a translation of a Swedish article which has been already summarized [cf. XXVII, 3856]. It is preceded by an editorial note in which the Mičurinist view on mutation is explained.

3574 Novikov, V. A.
Získávání nových znaků u rostlin změnou fotoperiodických podmínek během třetího stadia vývoje. (**New characteristics in plants as a result of changing photoperiodic conditions during the third developmental stage**).
Sborn čsl. Acad. zeměd. Věd: Řada rostlinná Výroba 1959 : **32** : 495–512.

Studies carried out in the Leningrad Province revealed that in the ontogenesis of agricultural plants, two further developmental stages occur after the end of the light stage. During these stages plants have specific environmental requirements; when these are not satisfied, development is abnormal. For example oats, millet, rye, tomato and cucumber require higher temperatures during the third stage than

during the light stage and plants require increased moisture and potassium during the fourth stage when they are also susceptible to a decrease in light intensity. During the third stage, the sex cells arise and the characteristics of progeny are decided; therefore changes in external conditions during this stage can, it is said lead to modifications which are inherited. The awned oat Golden Rain was allowed to begin the third stage under conditions of long photoperiod and then was given a 12 hr. photoperiod; treated plants yielded progeny with naked grain characteristic of *Avena nuda* but retained the type of panicle characteristic of Golden Rain. Eight subsequent generations have had naked grain. The winter rye Vjatka in similar experiments yielded a short form with a strong stalk and wheat-like grain; three generations having these characters have now been observed. Similarly, from a millet variety with dark grain, a type with light yellow grain was obtained; this character has been observed in four generations. A type of flax branching at ground level was also produced. By increasing the amount of ultraviolet radiation received during the third developmental stage, a cucumber with increased resistance to cold was bred.
Alteration of the photoperiod in the third developmental stage is thought to have considerable effect on the metabolism.

3575 Isely, D.
**Determination of variety or type in the laboratory and greenhouse—literature review.**
Proc. Ass. off. Seed Anal. N. Amer. 1956 : **46** : 75–97.
After a general discussion of the importance of trueness to type, and problems of seed testing and methods of varietal determination, the subject is reviewed under crop headings.

3576 Nya original- och rikssorter. (**New original and national varieties**).
Försök o. Forskn. 1959 : **16** : p. 5.

Nilsson-Leissner, G.
Nya original- och rikssorter av lantbruks- och köksväxter. (**New original and national varieties of agricultural crops and vegetables**).
Lantmannen, Stockholm 1959 : **70** : p. 35.
Brief notes on varieties of barley, *Poa*, clovers, poppy, radish, carrot, leek, spinach, cauliflower, cucumber and pea which have been awarded the designations "original" or "national" are presented.

3577 Lijst van proeven en proefbedrijven van rijkslandbouwconsulenten en andere instanties 1959. (**List of trials and experimental farms of national agricultural advisors and other authorities, 1959**).
Meded. LandbVoorlDienst, Wageningen 1959 : No. 75 : Pp. 119.
This outline of field experiments planned for 1959 in the Netherlands includes a list of new varieties of cereals, rape, caraway, peas, beans, flax, poppy and potato not included in the 34th descriptive list of agricultural crop varieties.

3578 Korte beschrijving van de nieuwe rassen, welke in 1959 op de interprovinciale proefvelden worden beproefd en niet voorkomen in de 34ste beschrijvende rassenlijst voor landbouwgewassen 1959. (**Short description of the new varieties which will be tested on the interprovincial trial fields in 1959 and are not appearing in the 34th descriptive variety list for agricultural crops 1959**).
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1959 : **15** : 140–42.
Brief descriptions and information on parentage and place of origin are given for varieties of wheat, oats, rye, maize, barley, potato, flax, rape, poppy, pea and bean.

3579 Teixeira, A. J. da S. & Barbosa, L. A. G.
A agricultura do Arquipélago de Cabo Verde. (**The agriculture of the Cape Verde Archipelago**).
Mem. Trab. Minist. Ultramar, Lisboa 1958 : No. 26 : Pp. 178.
This general survey of agriculture in the above islands includes references to local varieties of maize, potato, sweet potato, cassava, *Caladium*, *Colocasia*, *Xanthosoma*, cotton, *Agave*, *Calotropis*, *Furcraea*, sugar cane, tobacco, coffee, castor-oil plant, *Jatropha*, fruit trees, groundnut and pulses.

3580 Sandison, A.
**Some problems in naming varieties.**
J. nat. Inst. agric. Bot. 1958 : **8** : 253–56.
A discussion is given of the bearing of the latest edition of International Code of Nomenclature for Cultivated Plants [cf. XXVIII, 2425] and of the recent report of the Committee on Transactions in Seeds upon problems of varietal nomenclature, likely to be encountered

by those practically concerned in the agricultural industry.

3581 Pirovano, A.
**Fissisti, evoluzionisti, mutazionisti e creazionisti. (Those who believe in fixity, evolution, mutation and creation).**
Agricoltura, Roma 1959 : **8** : 35–40.

The possibilities of evolution under conditions of reduced competition and artificial selection are illustrated by sugar beet and many ornamental plants and vegetables. Though useful plants for cultivation have been produced by mutation, their reduced vitality is thought to militate against mutation as a factor in evolution. The occurrence of entirely new characters in hybrid populations is illustrated by red carnations, roses and other flowers, and by a series of red grapes produced by the author: these include Angelo Pirovano, Conte rosso [Red Count] and an unnamed seedling 539, the reddest of all.

3582 Žukovskij, P. M.
**(At the centres of origin of the cultivated plants of Latin America).**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 262–72. [Russian].

The author gives an account of his expedition in Argentina, Chile, Peru and Mexico in 1958. Among the plants that receive special mention are the heterotic willow hybrid *Salix euro-americana* '1–154' (*S. humboldtiana* x *S. babylonica*) used for paper making, the giant *Ficus magnoliaefolia* and *F. laevigata*, the decorative *Chorisia speciosa* and *Ch. insignis*, various forms of single *Zinnia*, wild groundnuts (*Arachis monticola*), a great range of forms of *Solanum andigenum, S. vernei, S. acaule, S. subtilius* and other wild potatoes, many ornamental trees, wild *Carica papaya, Phaseolus aborigineus, Cucurbita andreana, Schinopsis lorentzii, S. balansae, Aspidosperma quebracho, Ananas macrodontes, Capsicum chacoense* and many species of *Solidago* in Argentina; *Libocedrus chilensis, Araucaria araucana* and many other conifers, giant *Flotovia diacanthoides*, wild strawberries (*Fragaria chiloensis*), *Salix chilensis, Cereus chilensis, Solanum maglia* and *S. tuberosum* in Chile and Chiloé; many wild potatoes and other tuberiferous species, tomatoes, Lima beans, *Nicotiana tomentosa, N. sylvestris* and the insect-resistant *Schinus molle* in Peru; and *Abies balsamea, Pinus montezumae* and many other conifers in Mexico.
The main research centres in agricultural science visited in the respective countries are enumerated, with indications of their main lines of activity.
Comment is made upon the attention given to breeding for resistance to physiological races of wheat stem rust in Argentina, in consequence of which the Argentine wheats are practically immune when grown in the Soviet Union. The importance of *Solanum acaule* for potato breeding is thought to have been exaggerated, and so far no useful seedlings have been obtained from it.

3583 Thombre, M. V.
**Chromosome numbers in some common flowering plants.**
Curr. Sci. 1959 : **28** : 206–07.

The *n* numbers reported include the following: *Asparagus racemosus*, 30; *Hibiscus rosa-sinensis*, 18; *Ipomoea pestigridis, I. pentaphylla*, 15; *Mucuna monosperma*, 11; *Parthenium hysterophorus* 18; and *Punica granatum*, 8.

3584 Beard, B. H., Haskins, F. A., & Gardner, C. O.
**Comparison of effects of X-rays and thermal neutrons on dormant seeds of barley, maize, mustard, and safflower.**
Genetics 1958 : **43** : 728–36.

The dormant seeds of these plants were treated with various doses of X rays and thermal neutrons and then planted in the greenhouse where observations were made on the height, percentage survival and pollen of the resulting plants. High correlation coefficients indicated that plant height, survival and frequency of normal pollen are in most cases reliable criteria of X-ray and thermal-neutron effects. In the case of X-irradiated maize, even plants which had received the highest doses of radiation showed relatively good survival percentages at 12 days after planting but at 32 days many more of these plants had died. Also at 12 days there was a close relationship between dose of X rays and plant height but at 32 days the relationship was less distinct. The data indicated that for many of the seedlings from X-irradiated seeds of barley, maize and mustard and from neutron-treated barley and maize grains death occurred during the third and fourth weeks after planting; for these species it appeared desirable to record height measurements during the second week after planting and survival measurements one month after planting.
Plant-height and normal-pollen data for each species were expressed as percentages of their

respective control values; linear regression coefficients were calculated and regression lines showing the relationship between normal pollen and plant height were plotted. For each species the slope of the regression line was greater for the X-ray treatments than for the neutron treatments, indicating that for each unit of reduction in normal pollen, plant height was reduced more in the X-ray series than in the neutron series. The data on pollen also indicated that the dose of radiation required to produce a certain level of chromosomal abnormality differed widely for the four species with both kinds of treatment. All species showed similar relationships between relative plant height and relative percentage of normal pollen indicating that the influence on plant height per chromosomal abnormality was also similar.

3585 Pospíšilová, J., Toul, V., & Dupal, R.
Rychlá modifikace metody stanovení provitaminů A v rostlinách. (**A quick modification of the method of determining provitamin A in plants**).
Sborn. čsl. Acad. zeměd Věd: Řada rostlinná Výroba 1959 : **32** : 583–94.

In this modified method, dehydration, extraction of the material and washing of the extracted pigments are effected in one operation using an Erlenmeyer flask. A chromatogram is made using the extract and the quantity of provitamin measured by a colorimetric method. This procedure is quick and simple and therefore useful for investigations of breeding material.

3586 Björkman, O., Florell, C., Holmgren, P. & Nygren, A.
**The phytotron at the Institute of Genetics, Uppsala, Sweden.**
Ann. Acad. reg. Sci. upsal. 1959 : No. 3 : 5–20.

A detailed description, together with plans and illustrations, is given of the above phytotron.

3587 Bálint, A., & Kovács, G. (Mrs.)
Az öntermékenyülés hatása a növények életrevalóságára és ennek evolueiós jelentősége. (**The effect of self pollination on the vitality of plants and its evolutionary importance**).
Növénytermelés 1958 : **7** : 269–77.

A review of work on the effects of cross and self pollination is presented. Tables are given showing that partial emasculation resulted in a decrease in seed set in both wheat and pea compared with the nonemasculated plants. This is regarded as evidence that self pollination is not necessarily deleterious.

3588 Dunne, J. P.
**A system for the control of pollination in insect and wind pollinated plants.**
Euphytica, Wageningen 1959 : **8** : 76–80.

Details of the construction and management of movable polyethylene cages for the controlled pollination of insect and wind pollinated plants are described. Two cage sizes are given, one suitable for one or two plants, the other for a family of about thirty plants. Satisfactory seed sets in *Brassica* species have been obtained in these cages.

3589 Kostecki, E.
Do dyskusji o metodyce hodowli roślin samopylnych. (**A contribution to the discussion on methods of breeding self-pollinating plants**).
Postępy Nauk Roln. 1957 : **4** : No. 4 : 143–46.

In this discussion, the view that selective fertilization occurs is criticized, the following results being noted. When plants of white-grained wheat were pollinated with a mixture of self pollen and pollen from red-grained wheat, one component being fresh and the other air-dried for 3–5 minutes, 80% fertilization was obtained from the fresh pollen and none from the dried, irrespective of which species provided the fresh pollen. Similar results were obtained for the beetroot Egyptian and sugar beet.

Sokolov, S. J.
**(Plant introduction and construction of green belts).**
Trud. bot. Inst. Komarov (Trans. Komarov bot. Inst.) : Ser. VI : 1957 : No. 6 : Pp. 327. [Russian].

The sixth issue in this series [cf. XXVIII, 3320] contains the following contribution of interest to plant breeders:—

3590 *Luks, Ju. A.* [*The development of scientific conceptions of the term variety (cultivar)*]. (*pp. 11–71*).

The development of the concept of the horticultural and agricultural variety, later to emerge as the concept of the cultivar, is traced, since the time of Linnaeus, in the works of a number of Russian and other botanists. It is pointed out that the Russian translations of Darwin's work fail to reproduce the fine distinctions he makes between variety, form, kind and sort. The relative role of environment and selection in forming cultivars was assessed differently by the writers who followed Darwin; the difference was accentuated, it is stated, by the division of biological thought into two

currents, as represented by the "idealistic" approach of the Weismann-Mendel school, who never succeeded in giving a clear definition to the term sort, and the other by the Russian Darwinists represented by Timirjazev, Rytov and Mičurin. The views of a number of representatives of both schools concerning the nature and definition of the cultivar are cited and the author outlines his own views on the essential points that should be incorporated in any definition. The definition presented is as follows: "A cultivar is the progeny of one or several mother plants which forms, particularly on being grown under conditions similar to those under which it was produced, a definite combination, maintained in the course of generations, of individuals of cultivated plants with relatively identical hereditary constitution and variation of specific characters".

3591 Gorskij, A. M.
**[An expedition to the Chinese People's Republic (Sinkiang province)].**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 49–56. [Russian].

This report of a scientific trip to Sinkiang gives descriptions of many varieties of agricultural and horticultural plants grown there, including wheat, maize, barley, grain *Sorghum*, cotton, mustard, rape, linseed, melon, water melon, pumpkin and different kinds of vegetables. Many plants were collected for the Institute of Plant Industry [cf. 3698].

3592 Chaudhri, I. I.
**Scope of plant introduction in agriculture and forestry of West Pakistan.**
Agriculture, Pakistan 1958 : **9** : No. 3 : 211–16.

The need for the establishment of a Plant Introduction Bureau in Pakistan is discussed. It is necessary for successful breeding work to be carried out and for new species and varieties to be introduced into the undeveloped areas. Brief mention is made of a few successful introductions, including *Artemisia maritima*, tobacco and betel.

3593 **(Brief characteristics of agricultural plants from abroad which have been added to the collection of the Institute of Plant Industry and proved outstanding in trials).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 79–85. [Russian].

A list of the varieties of the following crops, together with brief descriptions of the varieties, is presented: wheat, buckwheat, oat, rye, maize, barley, millet, rice, *Poa*, ryegrass, fescue, red clover, vetch, turnip, swede, sweet pepper, cotton, hemp, carrot, onion, garlic, lettuce, celery, tomato, pea, *Phaseolus* bean, lentil and parsley.

3594 Nováková, J.
Černání stonku u brambor. Odolnost vůči černání stonku. Předběžné sdělení.
**(Potato black leg. Resistance against black leg. Preliminary report).**
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1958 : **31** : 1233–46.

A large number of potato cultivars from different countries, wild *Solanum* species and some tomato varieties were tested for resistance to *Erwinia atroseptica*. On the whole the cultivated potatoes showed very little resistance; only Flava and Sickingen showed both tuber and haulm resistance. Beteka, Doré [Golden], Hilla, Saucisse [Sausage] and Triumph were moderately affected in tubers and haulms; Berlichingen, Bona, Frühnudel, Frühmölle and Vera were resistant only in the haulm. The most resistant wild species were *S. ajuscoense*, *S. brazilianum* and *S. boergeri*. Trešňové and Sans Pareille [Peerless] were the most resistant tomatoes; of the other tomatoes, Pruning, Racimigerum and Large-fruited Yellow were only slightly affected. A negative correlation was found between stalk damage and woodiness.

3595 Goto, M. & Okabe, N.
**(Studies on strains of *Erwinia carotovora*. III. On mucoid mutants).**
Shizuoka Daigaku Nogakubu Kenkyu Hokoku/Bull. Fac. Agric. Shizuoka Univ. 1957 : No. 7 : 1–10. [Japanese].

Mucoid mutants of the above fungus have been obtained by successive culture on beef-extract agar, especially in the presence of 1% glycerol. Data are provided on reversion rate and the composition of the polysaccharides produced.

Southey, J. F. (Editor).
**Plant nematology.**
Tech. Bull. Minist. Agric., Lond. 1959 : No. 7 : Pp. 175.

3596 *Jones, F. G. W. Beet eelworm and other root eelworms. (pp. 100–14).*

Attempts are being made to breed varieties of sugar beet resistant to eelworm. As the beet eelworm (*Heterodera schachtii*) is more polyphagous than the potato eelworm (*H. rostochiensis*) and may show local variation in virulence, attention should be directed towards

tolerance of invasion rather than efficiency of the hosts.

3597 *Howard, H. W. Eelworm-resistant potatoes—the present position.* (*pp. 157–60*).
Breeding for resistance to root eelworm (*Heterodera rostochiensis*) is being carried out in the United Kingdom using *Solanum tuberosum* ssp. *andigenum* 'CPC 1673, 1685 and 1690', which are resistant South American tetraploid clones. Resistance of these clones, which is due to a single dominant gene, is being combined with the high yield of European cultivated varieties under long-day conditions. In the clones an active root diffusate is produced, the larvae invade the roots but are unable to complete their development into mature females. However, occasional cysts are found on the roots of resistant plants and this suggests that a new race of eelworm occurs which is capable of forming cysts on resistant material.

3598 Mulvey, R. H.
**Susceptibilities of plants to the clover cyst nematode, *Heterodera trifolii*, and the period required to complete a life cycle.**
Nematologica, Leiden 1959 : **4** : 132–35.
The degree of infestation of several clover species, different bean, pea, lucerne and onion varieties, *Lotus corniculatus*, soya bean, *Vicia villosa*, swede, beetroot and *Chenopodium glaucum* are compared. Several clover species, the lucerne and onion varieties, *L. corniculatus*, soya bean, swede and beetroot were all resistant to infection. Two species of clover, Early Wisconsin pea and Seminole bean were only lightly infested. White Dutch Clover, several of the pea and bean varieties, *Vicia villosa* and *Chenopodium glaucum* were all heavily infested.

3599 Trouvelot, B.
Les services rendus à l'humanité par l'emploi des immunités naturelles des plantes a l'égard des ravageurs. (**The services rendered to humanity through the use of the natural immunities of plants towards pests**).
Meded. LandbHogesch. Gent 1958 : **23** : 573–78.
The occurrence of a wide range of resistance in plant families is exemplified by a diagram showing the relative rates of multiplication of *Aspidotus perniciosus* on various genera pertaining to different families. The desirability of taking into account immunity from pests while breeding for other characters is stressed and some examples of morphological and physiological resistance to insects are given.

## CEREALS

3600 Cussen, G.
**Report of cereal station, Ballinacurra 1956.**
J. Dep. Agric. Eire 1957–58 : **54** : 230–41.
**Wheat.** Selections from crosses made with the aim of combining quality with yield are under test; Atle, Atson, Peko, Kärn II [Kernel II] and Koga were among the parents. A stem-rust resistant selection of Redman x Hybrid 27 was used during 1956 in crosses with Progress, Atle, Atson and other wheats to develop varieties with high yield and stem-rust resistance. Selections from progenies of neutron-treated material were propagated for testing.
**Barley.** Since the malting barley Beorna was first developed from Spratt-Archer x Kenia, further selections from this cross have been made, many of which are notable for their strong straw and high yield. One selection, Spratt-Archer x Kenia 17/8, is regarded as particularly promising as a malting type while another, Spratt-Archer x Kenia 115, is a good fodder barley superior to Herta in yield and to Ymer in straw strength. Many other Scandinavian varieties have been used in crosses to develop a dual-purpose barley with stronger straw than Beorna but equal to this variety in yield and malting quality. Selection XC–11, induced by X irradiation and possessing short straw, good malting quality and unusually round grain but poor yielding ability, has been employed as a parent in crosses with high-yielding varieties. Breeding for resistance to loose smut, mildew and eyespot is also receiving attention. Barleys bred in Ireland and England have shown a higher degree of resistance to loose smut than foreign varieties such as Herta and Carlsberg. Some European types are however better as regards mildew resistance. The results of variety trials, including the European Brewery Convention trial [cf. XXVIII, 1681], are also summarized.

3601 Brady, J. J.
**Cereal variety trials at the Department's farms in 1956.**
J. Dep. Agric. Eire 1957–58 : **54** : 169–80.
A report is given on trials conducted by the Department of Agriculture, Irish Republic, on the following: the spring wheats Atle, Atson, Kärn II [Kernel II], Koga II, Peko and Svenno; the spring oats Blenda, Pendek, W16004, Rex, Sun II, Bamboo II and Glasnevin Triumph; and spring barleys Ingrid, Herta and Spratt-Archer x Kenia selections 22/11, 17/8, 33 and 115 [cf. 3600 and 3503].

3602 Hänsel, H.
Geschichte und Bedeutung der Kombinationszüchtung bei den Getreidearten. (**History and importance of combination breeding in cereal species**).
Schr. Ver. naturw. Kenntn. Wien 1956–57 : **97** : 1–21.
In this short survey, special mention is made of the work of Tschermak in Austria.

3603 Kostecki, J.
Rozważania nad oceną materiałów hodowlanych u zbóż. (**Considerations on the evaluation of breeding material in cereals**).
Postępy Nauk Roln. 1957 : **4** : No. 1 : 37–41.
In this general survey, the need for detailed analysis and selection of the morphological and physiological characters of parental material at all stages of breeding is stressed. Selection for yield need not be introduced at the first stage but should take priority over other characters at the final stage.

3604 Musijko, A. S. & Ključko, P. F.
(**Using Mičurinist methods in breeding cross-pollinating plants**).
Dokl. Vsesojuzn. Akad. seljskohozjajstv. Nauk Lenin (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 9 : 3–6. [Russian].
The breeding of cereals at the Lysenko Institute at Odessa by the method of restricted intervarietal open pollination is discussed. The buckwheat Odessa, from Bogatyr' [Hero], the rye Odessa 1, from Veselyj Podol, and the maize Odessa were so obtained [cf. XXVIII, 2920].
The new buckwheat is resistant to drought and outyields Bogatyr' by 2·2 c. per ha. The rye Odessa 1 is more productive than the standard variety Tarašča 2 and shows improved resistance to *Puccinia* and *Oscinella*.

3605 Vettel, F.
Züchtungsmethodische Fragen der Neu- und Erhaltungszüchtung bei Weizen, Gerste und Hafer. (**Breeding-method questions of new and maintenance breeding in wheat, barley and oats**).
SB dtsch. Akad. LandwWiss. Berl. 1957 : **6** : No. 6 : Pp. 39.
It is thought that there should be more back crossing and convergent breeding in order to make the best use of the genes available in world collections. Also mutation breeding is used insufficiently for the improvement of varieties. The bulk method of breeding is considered to be of importance only in attaining definite aims such as resistance to drought. Mass selection however can be used effectively in connexion with the breeding schemes used at Hadmersleben and Weihenstephan. All these schemes, which are here described in detail, involve early selection in $F_2$ and $F_3$ generations. Using these schemes, much time and expenditure can be saved. Results obtained using the Hadmersleben schemes are described in detail. Also the method of maintenance breeding used at Hadmersleben is fully described.

3606 Oehler, E.
Art- und Gattungsbastarde bei Getreide und ihre Ausnützung für die Züchtung. (**Species and genus hybrids in cereals and their exploitation for breeding**).
Schweiz. Landw. Mh. 1959 : **37** : 168–73.
A brief survey is provided of the above subject, reference being made to hybrids of wheat, barley and rye.

3607 Carson, G. P.
**Descriptions of wheat and oat varieties.**
J. nat. Inst. agric. Bot. 1958 : **8** : 294–96.
Botanical descriptions are given of the winter wheat Milfast [cf. XXVIII,1498] and winter oat Penrhyn [cf. 3752], both recently added to the recommended lists issued by the National Institute of Agricultural Botany, UK. Penrhyn was developed from S147 x 0379 [a line selected from Unique x (Marvellous x Grey Winter)] at the Welsh Plant Breeding Station.

3608 Valle, O., Paatela, J. & Saksa, P. J.
Tärkeimmät viljalajikkeemme ja niiden viljelyalueet v. 1955. (**The most important of our cereal varieties and their areas of cultivation in 1955**).
Suom. Maatalousk. Seur. Julk. 1958 : **93** : No. 1 : 1–42.
A survey was made of the proportions of different varieties of cereals cultivated in different parts of Finland. Data are given for 21 agricultural associations grouped into four geographical areas.
**Spring wheat.** This crop is cultivated throughout Finland, except for Lapland, but principally in the south. The predominant varieties are Timantti [Diamond] and Timantti II which represent 27·8 and 25·0% of the total. In central and northern Finland, Apu [Aid] is predominant, comprising over 50% in the latter. These results show a big drop in cultivation of Timantti, and an increase in several other varieties such as Kärni [Kernel] and

Tammi. Several others, including Apu, were not in cultivation in 1950.

**Winter wheat.** Cultivation is restricted to southern Finland; Varma [Sure] represents 56·8% of the total. This figure is a drop of 7·4% on the figure for 1950; Olympia has also dropped from 20·9% to 10·2 while Virtus has increased from 0·5 to 8·7% of the total winter wheat varieties grown.

**Oats.** This crop is cultivated throughout the country, although with decreasing frequency towards the north. Sisu [Courage] is the commonest variety, although principally used in the south; in central and northern Finland, Tammi is preferred, accounting for 67·5% of the total in the latter. In Lapland, Orion II and III occupy 76·7% of the land under oats.

**Winter rye.** This crop is cultivated throughout Finland, Toivo [Hope] being the principal variety, although in central and north Finland unimproved strains account for 21·3 and 15·6% of the total. Ensi [First] is the most common of improved varieties in Central Finland; Sangaste is predominant in the north.

**Barley.** This cereal is grown throughout the country, being more predominant in the north. Tammi is the commonest variety, representing 84·2% of the total in Lapland and 64·1% in northern Finland. In the south, Balder (43·4%) and Binder (26·3%) are more common.

The varieties of all cereals grown are chiefly from Tammisto; a smaller proportion come from Jokioinen; 30% are Swedish.

3609 **Seed bulletin. Spring-sown cereals.**
IVRO, Wageningen 1957 : Pp. 19.

**Supplementary seed bulletin. Spring-sown cereals.**
Ibid. 1958 : Pp. 7.

Eighteen barleys, 25 oat varieties and seven wheats recommended for the Netherlands are briefly described and information given on their yields and other agronomic characters. Further data are given in the supplement and two additional barleys described.

3610 **Seed bulletin. Winter-sown cereals.**
IVRO, Wageningen 1957 : Pp. 15.

**Supplementary seed bulletin. Winter-sown cereals.**
Ibid. 1958 : Pp. 6.

Descriptive notes on 15 wheats, 8 barleys and 6 rye varieties recommended for growing in the Netherlands are given, together with data on yields. The supplement includes information on four additional wheats and one barley.

3611 Popow, G. & Buchli, M.
Kurze Beschreibung der Sommerweizen-, Sommergersten- und Hafersorten des schweizerischen Richtsortimentes 1959. **(A short description of the spring wheat, spring barley and oat varieties of the Swiss Official Collection, 1959).**
Mitt. schweiz. Landw. 1959 : **7** : 74–80.

Brief descriptions are provided of four wheat, five barley and nine oat varieties.

3612 Săläğeanu, N. & Taşcă, C.
**On transpiration during daytime and during the vegetation period and on the economic coefficient of transpiration for certain cereals.**
Rev. Biol., Bucureşti 1957 : **2** : 187–200.
[Cf. XXVIII, 236].

3613 Fedorov, A.
**(Plants with an alternative habit).**
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : 42–43. [Russian].

The mode of development of the above kinds of wheat and barley sown on different dates at the Institute of Genetics of the Academy of Sciences is discussed in relation to their temperature and photoperiodic requirements. Mention is made of a hardy alternative wheat obtained by sowing the spring wheat Moskovka [wheat from Moscow] as a winter crop; it is as hardy as the winter wheat Moscow 2453. The alternative barleys Odessa 17 and Kruglik 21 are also mentioned for improved yield and overwintering ability.

3614 Vithal Rao, S.
**Male sterility and its utilization in hybrid seed production. I. Cereals and millets.**
Krishik, Hyderbad 1958–59 : **6** : 16–19.

Some of the literature on ♂ sterility in maize, rice and sorghum and on its value in hybrid-seed production in maize and sorghum is reviewed.

3615 Scheibe, A. & Meyer zu Drewer, H.
Vergleichende Untersuchungen zur Atmungsintensität der Wurzeln unterschiedlicher Genotypen bei Getreidearten. **(Comparative studies on the intensity of respiration of the roots of different genotypes in cereal species).**
Z. Acker- u. PflBau. 1959 : **108** : 223–52.

At Göttingen measurements were made of the amount of $CO_2$ produced by the root systems of varieties of wheat, oats, rye and barley in nutrient solutions or distilled water. The

weight of $CO_2$ produced by 1 g. of ash-free dry material in a given time was taken as a measure of the intensity of respiration. In all the species studied, the intensity of respiration decreased after the three to four leaf stage. Varieties within species differed in the intensity of respiration when compared at similar stages of development. In general the varieties which gave good performances even under unfavourable soil and climatic conditions were those with the highest rate of respiration; the more demanding varieties showed a lower intensity of respiration.

3616 Vavilov, N. I.
**(New data on the cultivated flora of China and its importance to Soviet breeding).**
Izv. Akad. Nauk SSSR (News Acad. Sci. USSR) : Ser. Biol. : 1958 : 744–48. [Russian].

Vavilov, N. I.
**(Endemic wheats and their importance to breeding).**
Ibid. 1958 : 748–51. [Russian].

In these posthumously published papers, the morphological and economic features of wheats, oats, barleys and rice which are thought to have evolved as a result of the combined effects of natural and artificial selection and of external conditions in China are described. The papers deal principally with Chinese wheats in a Soviet collection made in the early '30s. They are classified in a separate group, *Triticum vulgare* ssp. *sinicum*, this being justified by geographical, botanical and genetical considerations. Most are short-strawed forms, with short or no awns, characterized by great earliness, a high rate of grain filling and resistance to drought and brown rust; some are *inflatum* forms having twisted rudimentary awns. The grain is normally small and rounded and the ears have many florets, most of which develop into normal grains. Naked seed is the main feature of the oat forms. The barleys, like the wheats, are characterized by short straw and short or no awns. The absence of awns is a dominant character. Some hooded barleys have also been found. Among the rice forms which have evolved in China are ultraearly and awnless types.

3617 Ivanov, A. P.
**(Rare and wild species of cereals).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 69–70. [Russian].

The following species were collected in the montane districts of Armenia, Azerbaijan and Georgia by the Institute of Plant Industry in 1957: *Triticum timopheevi*, *T. aegilopoides*, *T. urarthu*, *T. araraticum*, *Secale kuprijanovii*, *S. montanum*, *S. chaldicum*, *S. vavilovi*, *Hordeum spontaneum* and *H. bulbosum*. Preservation of these wild species in a pure state and their utilization in hybridization is urged.

3618 **(The scientific reports of the agricultural expedition to Cambodia. I).**
Hyogo University of Agriculture, Sasayama, Hyogo 1958 : Pp. 108. [Japanese].

A general account is given of the Agricultural Expedition from Japan to Cambodia, which took place from January to May, 1957. The principal plants collected were varieties of rice and maize. The salient characteristics of these are given in tables. Local varieties of vegetables and fruits were also obtained.

3619 Salčeva, G. & Nedjalkov, N.
**(Studies on the winter hardiness of some wheat, rye and winter-barley varieties grown on brown forest soil near Sofia).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 95–124. (Bulgarian].

Among the wheats tested under field conditions, 14, 134, 301, 408 and Jubilejnaja 3 [Jubilee 3] were rated highly for winter hardiness. The hardiest rye variety was 59 and the hardiest barley 1241.

3620 Veredeling van tarwe en gerst op winterhardheid. **(Breeding wheat and barley for winter hardiness).**
Meded. Sticht. PlantVeredel., Wageningen 1958 : No. 18 : Pp. 71.

From a review of the literature, it appears that in North European races of wheat winter hardiness is frequently associated with marked low-temperature requirements, late spring development and procumbent habit in the young plant. A number of Russian, south European and North American wheats, however, may combine winter hardiness with slight low-temperature requirements, good spring development and erect habit.

Studies made at Wageningen, Netherlands, using special freezing chambers, showed that only the wheats Pévèle and Étoile de Choisy [Choisy Star] and the two barleys tested, Vinesco and Atlas, showed a marked decrease in hardiness with increased length of vernalization period. When hardening was followed by a period of dehardening, the greatest loss in cold resistance occurred in the least winter-hardy wheats; Swedish and Austrian varieties retained

their cold resistance well. Hardiness differed according to stage of development, several wheats which are otherwise hardy being very tender in the coleoptile stage. North-west European varieties were generally not hardy at this stage. Studies on overwintering at different stages of development indicate that selection for winter hardiness may be effected by vernalization followed by autumn sowing, this method being useful where winters are not always severe.

In crosses between winter and summer forms, simple segregation for winter and spring habit did not occur in either wheat or barley. In most crosses, $F_2$ plants exceeding both parents in earliness were found. Long days reduced the percentage of winter forms in both the $F_1$ and $F_2$. Wheat crosses produced a higher proportion of winter forms than barley. Cold resistance in the $F_1$ was intermediate under short days and was reduced under long days in both the $F_1$ and $F_2$.

In most crosses between winter and spring barleys no improvement in winter hardiness was attained in the hybrids, but some transgressive segregation for hardiness occurred in Frisia x Purdue and Frisia x D36. A number of combinations of *Hordeum spontaneum* var. *nigrum* have given promising results in the $F_1$. In crosses involving French or Italian wheats on the one hand and German or Swedish varieties on the other, the hardiness of the latter parents was generally not reached and the desired combination of hardiness with vigorous spring development was rare. Among crosses between spring and winter wheats, those in which the spring forms were of the transitional type, such as Peko, Reliance and the Canadian lines 3842, 3843, 3845 and 3847, yield hybrids surpassing the parents in hardiness. Promising winter hardiness was shown by crosses of hardy south European and American varieties with a number of German, French and Italian varieties.

3621 Stroun, M. & Pugnat, C.
Relations entre l'accomplissement du photostade et la résistance au froid des céréales. (**Relations between completion of the photostage and the resistance of cereals to cold**).
Phyton 1958 : **11** : No. 1 : 1–14.

It has been found that the photoperiodic requirements of cereals are positively related to their resistance to cold. Winter cereals which require more favourable photoperiodic conditions than spring cereals in order to complete their photostage are more resistant than the spring varieties. It is possible to assess the resistance to cold by analysing photoperiodic behaviour. Three elements have to be considered: (1) the time required for the completion of the photostage in continuous daylight; (2) the sensitivity threshold, which is the photoperiod below which development is clearly retarded, and (3) the sensitivity quotient which is the ratio of the time necessary for completion of the photostage when the photoperiod is long to the corresponding time necessary with a short photoperiod. If two varieties are similar as regards (1) and (2), the one with the lowest sensitivity quotient is the most resistant; such a variety takes more time to pass through the first stages of organogenesis under conditions of reduced photoperiod. The photostage behaviour of four wheat varieties has been compared and the relative resistances to cold determined; the results agreed with those of other workers who observed the behaviour of these wheats during winter months.

3622 van Dobben, W. H.
Het effect van hitteschade bij granen tijdens de bloei. (**The effect of heat damage in cereals during flowering**).
Jaarboek 1958 : Med. Inst. biol. Scheikund. Onderz. LandbGewass., Wageningen 1958 : 21–28.

The work described has already been summarized from another source [cf. 2310].

3623 Chada, H. L.
**Insectary technique for testing the resistance of small grains to the greenbug.**
J. econ. Ent. 1959 : **52** : 276–79.

A technique is described for testing the resistance of small-grain cereals to the aphid *Toxoptera graminum* in a controlled-environment insectary, with an average temperature of 75° F. and a 16-hr. photoperiod. The relative humidity is not controlled, since it remains between 50 and 60%. Test varieties, grown in flats covered with plastic cages, are subjected to uniform infestation for 10–14 days, and then rated according to the leaf area damaged on each plant. The resistant varieties are then subjected to heavy infestations and the number of days the plants live is recorded. These varieties are also tested for antibiosis; a single female that has not reproduced is placed on each plant which is then covered with a plastic cage. Seven days later counts are made of the progeny of each aphid. The reactions of hybrids with aphid-resistant parents is also observed in the

insectary. It has been found that the percentage of resistant selections of the various crosses has increased from year to year.

3624 Downs, R. J., Piringer, A. A., & Wiebe, G. A.
**Effects of photoperiod and kind of supplemental light on growth and reproduction of several varieties of wheat and barley.**
Bot. Gaz. 1959 : **120** : 170–77.

A report is given of investigations carried out to determine the relative efficiency of lamps with different emission characteristics or envelope transmittance as sources of supplementary light for controlling the growth and flowering of wheats and barleys exposed to photoperiods of 12 and 16 hr. The artificial light was obtained from 40-watt fluorescent lamps or from 100-watt incandescent lamps with white, dark-blue or ruby-red envelopes. The wheats studied were Reward, Ramona 44, Lee, Marquis, Thatcher and Cadet, and the barleys Betzes, Herta, Trebi, Atsel and two lines isogenic except for contrasting genes for length of the awn on the glume ($72–E_2E_2–15$ and $72–e_2e_2–15$). Interactions of variety and photoperiod and of variety and kind of supplementary light are described for both crops.

## WHEAT

3625 Evans, A. W.
**Spring wheat variety trials, 1950–57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 257–70.

The results of 65 primary and 19 small-scale trials carried out in the British Isles are summarized. The entries comprised 13 varieties from Germany and other continental countries and one variety developed in England [Ritchie (Atle x an unnamed composite hybrid)], with Atle as control in most cases. Data are given on yield, disease resistance, straw length, lodging resistance, maturity and grain quality. Koga was the most productive. Svenno had the highest loaf score in baking tests and fair milling quality, combined with high yield and early ripening. Peko equalled Atle in yield and was notable for its good biscuit-making quality. These varieties have been added to lists of recommendations.

3626 Reiss, B. C. R.
**Winter wheat variety trials, 1952–56.**
J. nat. Inst. agric. Bot. 1958 : **8** : 271–84.

The report concerns 28 winter wheats studied in 73 trials in England and Scotland, with Bersée, Hybrid 46 and Holdfast as controls. Several of the potentially high-yielding French type of wheats were superior to Bersée but none surpassed Hybrid 46 in yield or other characters. Of the English type of quality wheats, Dominator and Milfast showed marked superiority over Holdfast in yield of red grain and were comparable to it in milling and bread-making properties. The adaptability of N59 in northern areas was confirmed. N59 is a white-chaffed, red-grained variety developed from a single-plant selection by Milns, Chester.

3627 Rivett, A. D.
**Winter wheat variety trials, 1954–57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 285–93.

A summary is given of the results of 42 trials of Leda, Mado, Panter, Tavero and Vilmorin 53 at 17 centres in England, with Hybrid 46 as control. None of the varieties equalled Hybrid 46 in all-round suitability, the nearest approach being made by Leda.

3628 Prove sperimentali sul grano, campagna 1957–58, eseguite dall' Istituto di Genetica di Lonigo. (**Experimental tests of wheat, season 1957–58, carried out by the Genetics Institute at Lonigo**).
Sementi elette 1959 : **5** : No. 2 : 54–57.

Tables are given showing which of the 25 cultivars tested gave the best yields in different parts of Italy. These results are combined with those of previous years to show which varieties were best in both yield and quality; in northern and central Italy, Produttore [Yielder] and Leonardo were highest in yield, the latter being classed as good in quality and the former as medium; Leone [Lion], classed as excellent in quality, was among the first six. In southern Italy the two wheats with the highest yields were Patrizio 6 (*Triticum durum*) and Forlani.

3629 Coltivazione nella Vojvodina delle razze di grano Italiane. (**Cultivation of Italian wheat varieties in the Vojvodina**).
Progr. agric., Bologna 1959 : **5** : 198–207.

The trials of Italian wheat varieties in Yugoslavia in 1956–57 [cf. XXVIII, 1572] were extended in 1957–58 and the results are reported. The best all-round yield was given by Produttore [Yielder], which is followed by S. Pastore and Mara. The mean grain yield of the Italian varieties was 41·76 c. per ha. against 27·49 c. from the local varieties, the difference at one

place being as much as 24·52 c. in favour of the Italian varieties. Elia, Produttore, S13 and Mara were most resistant to *Puccinia triticina* S. Pastore, Elia, Generoso [Generous] and Freccia [Arrow] to mildew and Mara to lodging, other lodging-resistant varieties being Fortunato [Fortunate], Fiorello, R16 and Produttore. The year 1957–58 was cold and dry and the fact that the Italian wheats did so well shows that they are adapted to such conditions; the widest range of adaptation was found in S. Pastore, while Produttore and Fortunato are slightly more sensitive to cold.

3630 Saloheimo, L.
Kevätvehnän viljelymahdollisuuksista keski-Suomessa. (**On the possibilities of spring wheat cultivation in central Finland**).
Suoviljelysyhdistyksen vuosikirja 1957 : 17–22.
The results of spring-wheat trials carried out during 1930–57 on hill soils and cultivated peatland at the Karjala experimental station of the Society of Peat Cultivation, central Finland, are reported. Comparative data are given for Timantti [Diamond], Ruskea [Brown], Pika II [Express II], Tammi, Hopea [Silver] and Apu [Aid]. Of these the last is particularly recommended.

3631 López-Ríoboo Tenreiro, F. & Prieto Heraud, E.
Ensayos comparativos de variedades de trigos. (**Comparative trials of wheat varieties**).
An. Inst. nac. Invest. agron., Madr. 1958 : **7** : 711–875.
Details are given of the results of trials of 92 varieties tested in various regions of Spain in the season 1954–55.

3632 Matweef, M.
Vingt-huit années de fonctionnement du Laboratoire de Technologie du Blé du Service Botanique et Agronomique de Tunisie. (**Twenty-eight years of the working of the Laboratory of Wheat Technology in the Botanical and Agricultural Service of Tunisia**).
Tunis. agric. 1958 : **59** : 131–42.
A brief survey is presented of the first 28 years of the Laboratory of Wheat Technology in Tunisia. Methods of selection and the more important varieties grown are mentioned.

3633 Dantuma, G.
Indrukken van het "First International Wheat Genetics Symposium" te Winnipeg, 11–16 Augustus 1958. (**Impressions of the First International Wheat Genetics Symposium at Winnipeg, 11–16 August 1958**).
Sticht. Ned. Graan-Centrum, Wageningen 1958 : 63–71.
Some of the papers read at the above symposium are discussed [cf. 2448].

3634 Reitz, L. P. & Salmon, S. C.
**Hard red winter wheat improvement in the plains.**
Tech. Bull. US Dept. Agric. 1959 : No. 1192 : Pp. 117.
New varieties have largely replaced the old varieties grown 25 years ago. Gains of 10–30% in grain yield and considerable improvement in bushel weight have been obtained by growing the new varieties. Earliness has been increased to the ultimate for this region unless new levels of physiological resistance to frost are discovered. Varieties that are shorter strawed without sacrifice of production of grain and that are resistant to lodging and storms have been produced. Winter hardiness has been increased only slightly in the northern part of the region and not at all in other districts. Leaf-rust and stem-rust resistant varieties have been obtained but none is resistant to all the prevalent races.

3635 Musatov, G.
(**Higher technical college helps industry**).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : 45–46. [Russian].
Mention is made of new forms of winter wheat selected by the Uman' Agricultural Institute from Ukrainka; they equal the parent variety in bread quality and outyield it by 3–5 c. per ha.

3636 Bočev, B.
(**Wheat varieties for the irrigated districts of this country**).
Kooper. Zemed. (Cooper. Fmg.), Sofija 1958 : No. 7 : 26–28. [Bulgarian].
Jubilejna I [Jubilee I], Jubilejna II, Jubilejna III, Åkerman, 804, a new variety from the V. Kolarov Institute, Sadovo, 0109 and the Soviet varieties Lutescens 17 and wheat-*Agropyron* hybrid 186 were the most productive cultivars in Bulgarian irrigated trials.

3637 Sikka, S. M. & Jain, K. B.
**Inheritance of leaf blotching in an intervarietal cross of *Triticum aestivum* L.**
Curr. Sci. 1959 : **28** : 191–92.

$F_2$ and $F_3$ data on E1844 (Supremo x Montana) x New Pusa 718 indicated that the chlorotic blotching exhibited by the former parent was recessive to the normal green condition of the leaves of the latter and dependent on a single gene. The blotching first appeared in the older leaves about 50 days after sowing and subsequently spread to the younger leaves.

3638 Hermsen, J. G. T.
De erfelijkheid van dwerggroei en verdorring bij tarwe. (**The inheritance of dwarf growth and wilting in wheat**).
Genen en Phaenen 1958 : **3** : 82–83. (Abst.).

Tabulated data on the $F_1$ and $F_2$ genotypes and phenotypes of wheats carrying genes for the semilethal characters dwarf growth and wilting are presented from the literature, together with the following observations on wilting. The latter may be explained as resulting from the action of the three complementary genes $W_a$, $W_b$ and $W_c$ [cf. 3701], which produce a dosage effect such that $W_aW_aW_bW_bW_cW_c$ is lethal and $W_aw_aW_bw_bW_cw_c$ shows only slight wilting; in addition modifying factors appear to be present.

3639 Medvedeva, G. B.
(**Characteristics of dominance and segregation of characters in wheat on pollination with a pollen mixture**).
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 138–49. [Russian].

Observations on the wheat crosses involving two pollen parents were continued [cf. XXVIII, 58]. When pollen of Ukrainka, having red grains, and of Alborubrum 2671, having red ears, was applied together to Albidum 26805, which is recessive for both characters, the $F_1$ contained 154 plants with red grain, 30 with red ears, 47 with both red grain and red ears and 35 double recessives. The first group gave an $F_2$ with 74·2% of red grains and 20·7% of red ears, 9·6% having both red ears and red grains. Moreover, some of the red-grained families were awnless, though the Ukrainka parent is awned. The characters of Alborubrum 2671 have been transmitted, it is thought, not through union of gametes but by assimilation, as in vegetative hybridization.
In the $F_2$ from the second group, 70·8% of the plants had red ears and only 3 had red grain, 2 of these having red ears too; there were no awned plants.
The $F_2$ from the 47 double dominants had 71·7% of plants with red grain and only 48·6% with red ears, 29·8% being red in both grain and ear; 5·9% were awned.
The 19 plants of the maternal type gave an $F_2$ in which 61·1% had red ears, 2·8% red grains and 3 plants had both red ears and grains; 14 families segregated for ear colour and 3 for grain colour; there were no awned plants.
In pollinations of Albidum 26805 with pollen from Velutinum 442, having pubescent glumes, and Milturum 120, having red ears, the $F_1$ comprised plants having (1) smooth red glumes, (2) pubescent white glumes, (3) smooth white ears with red grain and (4) smooth white ears with white grain. The $F_2$ from group (1) contained 74·9% red ears, all plants having smooth glumes; that from group (2) had all plants with white ears and segregated into rough and smooth. The $F_2$ from group (3) had 61·1% red ears and no pubescent forms. Group (4) maintained its maternal characteristics in the $F_2$.
In pollinations of Erythrospermum 599 with Milturum 120 + Velutinum 442, the $F_1$ had five types, (1) smooth red ears, (2) rough white, (3) rough red, (4) smooth white awnless and (5) smooth white awned (maternal type). Group (1) gave an $F_2$ with all smooth ears, 77·9% being red. The $F_2$ from group (2) had all white ears, 27·9% being pubescent. Group (3) gave an $F_2$ with 32·2% rough ears and 3·2% red ears; three plants with red pubescent ears appeared. Group (4) gave an $F_2$ with all smooth ears, 64% being red. Group (5) continued to reproduce the maternal type.

3640 Lukianenko [Luk'janenko], A. P.
Despre selecţa şi raionarea soiurilor de grîu de toamnă pentru diferite culturi premergătoare. (**On the breeding and regional standardization of winter-wheat varieties for different types of rotation**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 1 : 94–103.

[Cf. XXVI, 310].

3641 Karapetjan, V. R.
(**The problem of the species and the origin of species in the light of investigations on interspecific crossing in plants**).
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 35–75. [Russian].

The various forms of sterility encountered in

wide crosses and the methods used by Mičurin and his followers for overcoming it are outlined. Though in crosses between different species of *Triticum, Secale* and *Agropyron* the fertility is generally higher when the species with the higher chromosome is taken as the maternal parent, chromosome number is not regarded as the decisive factor in sterility, which is thought to be due to incompatibility of the characters of the given species. Figures are given showing the percentage survival of the seedlings in different combinations. A detailed study was made of crosses of *T. durum* x *T. vulgare* and the reciprocals. The set of grain varied in the different parental combinations from 0 in *T. durum* 'Zarda' x *T. vulgare* 'Ukrainka' to 22·4% in *T. durum* 'Melanopus falcatum' x *T. vulgare* 'Mesopotanicum'. The germination percentage was invariably higher in the crosses in which *T. vulgare* served as maternal parent but the fertility of the $F_1$ plants was correlated with the percentage set of grains. The fertility was greater when the hybrid plants were grown at low temperature, by which means sets of up to 75–80% were obtained. Plants resembling one or other of the parental species were more fertile than the intermediate types. In the $F_2$ there were generally larger numbers of plants resembling the maternal parent than those resembling the pollen parent. Certain combinations were found in which the plant was of the *T. vulgare* type and the grain resembled that of *T. durum*. Several cases occurred in which $F_2$ plants belonged to species other than the parental species, for instance *T. dicoccum* or *T. spelta*; chromosome counts showed the former to have $2n = 28$ and the latter $2n = 42$. These divergent forms bred true in later generations and their origin is ascribed not to the combination of characters from the parent species but to the influence of environmental conditions.

A small amount of seed was obtained from crossing *T. dicoccum* with *T. vulgare* and larger amounts from *T. dicoccum* crossed with *T. durum* and *T. turgidum*, in which the germinating capacity of the grain produced was also higher. Many sterile dwarfs occurred in the $F_2$ generation of *T. dicoccum* x *T. vulgare*; in most plants the grain bore more resemblance to bread wheat, though the morphological features were closer to *T. dicoccum*; forms resembling *T. spelta* and *T. compactum*, having $2n = 42$, and *T. durum*, having $2n = 28$, occurred and bred true in later generations.

In crosses of *T. vulgare* with *S. cereale* the best results were obtained when the wheat was used as seed parent, the highest sets, up to 85·7%, being given by var. *barbarossa*. The hybrids were all self sterile but a small number of seedlings were obtained from back crossing and from open pollination; they all resembled either wheat or rye and no intermediates occurred. Seedlings obtained from the reciprocal cross all resembled rye and had $2n = 14$. It is therefore concluded that the production of hybrids combining the characters of rye and wheat is not possible, it being further pointed out that the wheat-rye hybrids of Meister and the *Triticum-Agropyron* hybrids of Cicin are in no way distinguishable from ordinary wheat varieties. Interspecific crossing is considered to be of use in plant breeding only as a means of shattering the hereditary constitution.

3642 Bazavluk, V. Ju.
**(The processes of form production on crossing the Kahetinskaja branched wheat with winter bread wheats).**
Trud. Inst. Genet. (Trans. Inst. Genet.). 1958 : No. 2 : 182–94. [Russian].

Further data are given on some of the hybrids described previously [XXII, 1072]. In the $F_2$ and $F_3$, the branched ears were most often associated with spring habit and the *Triticum durum* type of ear. The progenies of unbranched $F_2$ and $F_3$ plants often contained branched forms but in lower numbers than the progenies of branched forms. From the $F_4$ onwards selection was carried out for branching ears but segregation continued until the $F_7$ or $F_8$, when some families with 100% branching began to appear. In one of these the main ear bears up to 140 grains; it is of the *T. turgidum* type with $2n = 28$, but behaves as a winter wheat and is resistant to mildew and lodging, having thin, very elastic straw.

Two unbranched forms that appeared in the $F_7$ and $F_8$ are described; both are of the *T. vulgare* type but have a larger number of grains per ear than the initial parent. Others resembled *T. compactum*, *T. vaneum* or botanical varieties other than those of the parents.

The germination capacity of the hybrid grain was higher when *T. vulgare* served as seed parent, grains from the reciprocal cross often having defective embryos.

The proportion of branched forms was 7% greater in the progeny of $F_7$ plants that were interpollinated than in those left to open pollination. Progeny from small grains gener-

ally had a higher proportion of branching than progeny from larger grains.

3643 Omar, A. A. M. ['Umar, 'A. ul 'A.].
**"Shift" in wheat: an analysis of glume and grain length inheritance in the cross *Triticum polonicum* L. x *T. durum* Desf.**
Ann. agric. Sci., Cairo 1957 : **2** : No. 2 : 233–41.

Engledow found that in a cross between *T. polonicum* (long glumes) and *T. durum* 'Kubanka' (short glumes) the parental types segregating in the $F_2$ deviated widely from the corresponding parents in grain and glume lengths. The $F_2$ *T. polonicum* type was considerably reduced in grain and glume lengths while the $F_2$ Kubanka type showed an increase in these two respects. Both types were true breeding in the $F_3$. Engledow used the term shift for the phenomenon. The author reports a repeated study of the cross between these wheats, acrried out at the Cambridge University Farm, England, during 1936–38. The data on grain and glume lengths led to the conclusion that the *T. polonicum* parent used by the author had already shifted, whereas the Kubanka parent was a pure unshifted type. Each parental type bred true for the two characters, no evidence of shift being obtained from the segregates. The author is in agreement with Engledow in concluding that the phenomenon of shift will "remain a matter of uncertainty".

3644 Riley, R., Chapman, V. & Kimber, G.
**Genetic control of chromosome pairing in intergeneric hybrids with wheat.**
Nature, Lond. 1959 : **183** : 1244–46.

Previous investigations on Holdfast by Riley and Chapman [1381] revealed that control of the diploid-like meiotic behaviour of *Triticum vulgare* was exercised by a gene on a particular chromosome, designated HH. As shown by Sears and Okamoto [1098], chromosome V in Chinese Spring carries the gene responsible for restriction of homeologous pairing. It has not however yet been possible to confirm that chromosome HH is homologous with V in Chinese Spring. With a view to determining whether the genetic control restricting pairing between homeologous chromosomes in *T. vulgare* is also responsible for the failure of wheat chromosomes to pair with those of some species in related genera, a study was made of crosses of *T. vulgare* 'Chinese Spring' monosomic V with *Aegilops longissima* ($2n = 14$) and *Secale cereale* 'King II'. The monosomic parents produced gametes with $n = 21$ or 20, depending on whether or not the single chromosome V was included. Consequently, the same ♀ parents gave rise to hybrids with $2n = 28$ or 27, seven of the chromosomes being derived from the ♂ gamete. In the 28-chromosome hybrid with *Ae. longissima*, the number of bivalents per cell never exceeded 6, the mean being only 1·96. This degree of bivalent pairing is only slightly higher than in euhaploid Holdfast. Since little homology exists within the haploid complement of *Ae. longissima*, a small amount of pairing between wheat and *Aegilops* chromosomes was indicated. In 27-chromosome hybrids with *Ae. longissima*, the frequencies of univalents, bivalents, trivalents and quadrivalents in two lots of material were respectively: $9{\cdot}85 \pm 0{\cdot}33$, $7{\cdot}50 \pm 0{\cdot}35$; $6{\cdot}45 \pm 0{\cdot}19$, $7{\cdot}58 \pm 0{\cdot}23$; $0{\cdot}87 \pm 0{\cdot}09$, $0{\cdot}70 \pm 0{\cdot}08$; $0{\cdot}41 \pm 0{\cdot}05$, $0{\cdot}56 \pm 0{\cdot}05$. The ranges in the number of chromosomes conjugating were respectively 10–24 and 10–27. Univalent frequency was almost the same as in HH nullihaploid Holdfast ($2n = 20$), so that evidently the seven extra chromosomes were often involved in pairing. Compared with the nullihaploid, the frequency of bivalents was increased by more than half and the quadrivalent frequency 20 times. The amount of association in the 28-chromosome hybrid with rye was not higher than in euhaploid Holdfast. Although as many as 21 chromosomes might be involved in associations in one cell in the 27-chromosome hybrids with rye, on the average fewer chromosomes were paired than in HH nullihaploids of Holdfast. These 27-chromosome hybrids had, however, about the same number of trivalents and more than four times as many quadrivalents as the nullihaploids. They also contained some large complexes, associated by chiasmata and involving up to 11 chromosomes. "The large complexes probably arose because there is not a strict one-to-one relationship between rye chromosomes and wheat homoeologous groups [because] the rye chromosomes differ from chromosomes of the wheat groups by translocations." The significance of reducing the barrier to the pairing of wheat chromosomes with those of other genera by excluding chromosome V is discussed from the point of view of breeding, ways in which 27-chromosome hybrids

may be used to obtain favourable recombinations being suggested.

3645 NAKAJIMA, G.
**[Cytogenetical studies of the triple hybrid (*Triticum turgidum* x *Secale cereale*) x *T. vulgare*. V. Germination of the $F_3$ seed and the somatic chromosome numbers, external characteristics and fertility of the $F_3$ plants].**
Idengaku Zasshi/Jap. J. Genet. 1958 : **33** : 405–17. [Japanese].
The cytology and morphology of the $F_2$ generation of the above cross are described in the two preceding papers of this series [XXIV, 201 and XXIX, 2456]. The present paper deals with the morphology of the ear and chromosome numbers of the $F_3$. The 177 $F_3$ hybrids obtained fall into three groups: (1) $2n = 28–32$ from $F_2$ plants with $2n = 29–33$; (2) $2n = 32–43$ from $F_2$ plants with $2n = 37–39$; and (3) $2n = 40–49$ from $F_2$ plants with $2n = 37–39$. Fertility is bimodal with a distinct mode at $2n = 28–29$ and a less well-defined mode around $2n = 45–49$.

3646 IVANOVSKAJA, E. V.
**[The endosperm structure of the grains produced by pollinating wheat (*Triticum durum* and *T. vulgare*) with *Elymus* (*E. arenarius* and *E. giganteus*)].**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 19–34. [Russian].
Further studies [cf. 2419] of the structure of the hybrid grains show them to be frequently deficient in endosperm development. The form of the endosperm varied in different hybrid combinations. In some grains the endosperm was absent altogether but such grains sometimes had a well developed embryo and it was possible to get quite good seedlings from them by culture on artificial media. Other grains were without embryos. Thus the hybrid nature of the grains seems to cause defective development in embryo and endosperm independently, both being however the result of disturbances in metabolic activity. In the structure of the starch the hybrid endosperms bore greater resemblance to the *Elymus* parent, in that each cell contains either all large or all small starch grains and no chondriosome starch was formed. Defective development of the aleurone layer was a frequent occurrence.

3647 LAPIN, P. I.
**(Summary of the construction and research work of the Principal Botanical Garden of the USSR Academy of Sciences).**
Bjull. Glavnogo Bot. Sada (Bull. Princ. Bot. Gdn.), Moskva-Leningrad 1958 : No. 31 : 3–11. [Russian].
An outline is given of the activities of the garden since its foundation in 1945. One of these is the establishment of collections of the cultivated and wild plants of the USSR and elsewhere and the study of their behaviour under different sets of conditions. Another is the work on distant hybridization carried out by N. V. Cicin, the director, and his colleagues [cf. 2410–26], in which the adaptation of wild plants to unfavourable growth conditions is being transferred to cultivated plants. *Triticum-Agropyron* winter-wheat hybrids 1, 186 and 599 were grown on 250,000 ha. in 1958 and hybrids 7, 56 and 173 are now showing promise. The perennial hybrids give two yields, one of grain and one of hay of high nutritive quality. The production of these wheats has demonstrated how a new species arises gradually, through a succession of intermediates which later die out, from an earlier species.

3648 **(Celebrations in honour of Academician N.V. Cicin).**
Vestn. Akad. Nauk SSSR (Rep. Acad. Sci. USSR) 1959 : No. 4 : 111–12. [Russian].
This article, paying tribute to N. V. Cicin on the occasion of his 60th birthday on 18 December 1958, mentions *Triticum-Agropyron* hybrid 56. It is said to be promising for the new Siberian and Kazah areas under wheat.

3649 LJUBIMOVA, V. F.
**(Inheritance of teratological changes in *Triticum-Agropyron* hybrids).**
Bjull. Glavnogo Bot. Sada (Bull. Princ. Bot. Gdn.), Moskva-Leningrad 1958 : No. 32 : 53–59. [Russian].

**(The origin and inheritance of some new characters in wheat-*Agropyron* hybrids).**
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1959 : **125** : 197–200. [Russian].
Multipistillate flowers have been observed in over 20 different hybrids, all derived from perennial hybrid M2 pollinated by *A. glaucum*, *A. elongatum* or *A. glael* (= *A. glaucum* x *A.*

*elongatum*); in many of the hybrids some of the stamens are transformed partially into stigmas. The abnormalities were maintained when the plants were multiplied clonally. No viable progeny was obtained by self pollinating the abnormal flowers, though some of them produced varying amounts of fertile pollen. A few grains were produced by open pollination and in this way $F_2$–$F_4$ generations were obtained. There was a reduction from generation to generation in the proportion of florets with transformed stamens but a rise in the proportion of multipistillate florets. In the $F_4$ generation segregation occurred, some plants being completely normal.

3650 **Successful hybrid may lead to better wheats.**
Crops & Soils 1959 : **11** : No. 8 : p. 21.

Leaf rust resistance of *Agropyron elongatum* has been successfully transferred to the hard red winter wheat Triumph at Oklahoma Experiment Station. The new hybrid gave the best yields in 1958 and showed no signs of leaf rust. Milling and baking qualities are as good as those of Triumph. The early maturity of Triumph was lost in the cross, the hybrid being of medium maturity.

3651 Pisarev, V. E.
**(Polyploidy phenomena in the breeding of high protein and "strong" wheats).**
Nung-yeh-hsueh Pao (J. Agric.)/Acta. agric. sin. 1958 : **9** : 214–23. [Chinese].

[Cf. XXVIII, 281 and 4044].

3652 Ivanov, A. P.
**(A "spontaneous" wheat-rye amphidiploid).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 39–41. [Russian].

Morphological and economic descriptions are given of an amphidiploid, which is thought to have arisen spontaneously from the open-pollinated wheat variety Erythrospermum 46/131, grown close to a rye field at Sverdlovsk. The amphidiploid, now in its fifth generation, breeds true and has a long ear, large grain and resistance to *Puccinia, Erysiphe* and lodging. Its origin is briefly as follows. Two wheat-rye hybrids which bore 6 underdeveloped grains were found among the $F_1$ of open-pollinated Erythrospermum 46/161. Plants were raised from the seed and multiplied by clones at Puškin. The $F_2$ showed great variability and included highly sterile plants with speltoid ears and wheats with almost normal fertility. The $F_3$ was grown under irrigation at Derbent, Dagestan, and it was then that 3 plants with characteristics intermediate between wheat and rye were found. The offspring of the plants with wheat and rye characteristics bred true and cytological analyses showed that they had 56 chromosomes.

3653 Sebesta, E. E.
**Cytological studies on certain wheat-rye hybrid derivatives.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–5597 : 1178–79. (Abst.).

Investigations were carried out on (1) a pure-breeding, partially fertile and leaf-rust resistant type intermediate between wheat and rye, (2) four wheat-like lines highly resistant to leaf rust in the mature-plant stage and (3) two wheat-like derivatives completely susceptible to leaf rust. All the selections were hairy necked. Selection (1) had $2n = 56$ and represented an amphidiploid type. Its meiosis was highly irregular, with lagging and division of varying numbers of chromosomes. Bridge formation and fragmentation occurred in both meiosis I and II. Group (2) had $2n = 44$ as the usual number. The extra pair of chromosomes were considered to be telocentric and the carriers of the gene or genes for leaf-rust resistance. Some plants in three of the lines were only moderately resistant and had $2n = 43$. Meiosis was somewhat irregular in the 44-chromosome plants and highly irregular in the 43-chromosome plants, because of lagging and division of the telocentrics. One completely susceptible plant ($2n = 42$) was found in one of the resistant lines. Selections in group (3) had $2n = 42$ and highly regular meiosis. Populations derived from two of the 43-chromosome individuals contained resistant, moderately resistant ($2n = 43$), and susceptible segregates ($2n = 42$). The resistant plants examined had $2n = 42 + 1$ pair of telocentrics, except for a single individual with $2n = 42 + 1$ isochromosome. Differences in degree of meiotic regularity were observed between these classes. Loss of one or two chromosomes had no effect on the expression of hairy neck.

3654 Noulard, L.
Mutations induites par rayons X chez "*Triticum aestivum* L." (1re note).
**(Mutations induced by X rays in *T. aestivum* L. I).**
Bull. Inst. agron. Gembloux 1958 : **26** : 135–50.

Dry grains of five recent hybrid varieties of

spring wheat were treated with various doses of X rays. No anomalies were observed in the $X_1$ generation harvested in 1955 but in 1956 many abnormal ears were found, speltoid aberrations being particularly frequent. Some plants bore two kinds of abnormal ear in addition to normal ones. The aberration frequency increased with the X ray dose applied. Fifteen different mutant forms were also found in the $X_2$ generation; these included early forms and short types with normal ears.

3655 Barabas, Z. (Jun.).
**An induced mutant in *Triticum carthlicum* with the diagnostic feature of *T. vavilovi*.**
Nature, Lond. 1959 : **183** : p. 1349.

A mutant of *T. carthlicum* induced by X irradiation at the Department of Genetics, Hungarian Academy of Science, Martonvásár, Hungary, resembled *T. vavilovi* in pseudobranching of the ear, elongation of the internodes of the rachilla and number of rachilla nodes. Crossing experiments have been initiated to determine the mode of inheritance of the mutant. The significance of the mutant in relation to the origin and taxonomic position of *T. vavilovi* is discussed.

3656 Sadykov, A. M.
**(The question of variability in cereals).**
Izv. Akad. Nauk Azerb. ASSR (News Acad Sci. Azerb. ASSR). 1957 : No. 1 : 111–25. [From Ref. Ž. (Ref. J.) 1958 : No. 6 : Abst. 23833 : p. 36]. [Russian].

Conversions of wheat into rye and of hard wheat into soft wheat are reported from the Kedabek district which is characterized by poor sandy soil. It is stated that rye grains arise more frequently in wheat ears when the wheat has been sown with immature grain or the sowing carried out later than is customary.

3657 Ponomarenko, F. A.
**(The phenomenon of dwarf habit of wheat plants and its effects on interspecific variation of the progeny).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 8 : 30–33. [Russian].

A large proportion of wheat plants in populations grown in the foot hills and highlands of Dagestan have a dwarfed habit (15–25 cm. tall). The progenies of these plants raised in the plain at Derbent had a normal height of 70–90 cm., but dwarfed plants occurred among the progenies raised at altitudes of 1160 m. and 1700 m. The following interspecific conversions were observed, mainly at high altitudes: *Triticum vulgare* → *T. compactum*, *T. persicum* and *Secale cereale*; and *T. persicum* → *T. vulgare* and *T. compactum*. It is concluded that the climatic conditions in the foot hills and highlands are at variance with the external requirements of wheat and are responsible for the conversions. The development of dwarfed plants is regarded as part of the same process.

3658 Jahtenfel'd, P. A. & Filimonova, T. G.
**(Shortening the growth period by means of sowing in summer).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 126–28. [Russian].

At Omsk, the spring wheat Milturum 321 and the millet Stahanovskoe acquired shorter growth periods after being sown in July for one generation instead of the customary earlier date.

3659 Kozlova, A. F.
**(Changing spring wheat into winter wheat).**
Izv. Kujbyšev. sel'skohozjajstv. Inst. (News Kujbyšev. agric. Inst.) 1957 : **12** : 55–58; from Ref. Ž. (Ref. J.) 1958 : No. 8 : Abst. 33426 : p. 33. [Russian].

The spring wheat Lutescens 801, which was grown for three consecutive years as a winter crop, is stated to have acquired the winter habit. Seven other spring varieties subjected to the same treatment retained their spring habit.

3660 Fedorov, A. K.
**(Conversion of spring wheats into winter wheats).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 213–31. [Russian].

Plants of the spring wheat Milturum 0321 had from 4·4 to 29·2% survivors when sown in autumn, according to the time of sowing, whereas two other spring wheats, Moskovka [wheat from Moscow] and Kitchener, had few or no survivors. The difference is explained by the fact that in Milturum 0321 the differentiation of the growing point is delayed in the short autumn days whereas in the other two wheats this is not so.

The progeny of the autumn-sown plants when again sown in autumn showed delayed development of the growing points compared with the original spring wheat; their habit was more procumbent and their growth rate less; their winter survival was better.

In the progeny of Moskovka autumn-sown there appeared plants belonging to vars. *erythrospermum* and *lutescens* in addition to the original

*graecum*; a number of winter plants also occurred. The progeny of the second autumn sowing of Milturum 0321 contained a number of winter plants which in cold resistance were equal to the variety Kooperatorka; the plants that did not behave as winter wheats were also more hardy than the original spring variety and in this and other features resemble alternative wheats. When the sowing was performed at the end of autumn (17 October) rather than at the normal time for autumn sowing, no conversion to winter forms occurred.

3661 Lysenko, O. T.
**(The influence of the time of the second autumn sowing on the conversion of spring wheat to winter wheat).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 232–37. [Russian].

When the spring wheats Milturum 321, Odessa 13 and Lutescens 1163 were sown for two successive years early in the autumn, in late August or early September, their progeny contained a higher proportion of winter plants and of plants belonging to other botanical varieties than when they were sown in late autumn. The percentage survival in both groups was roughly the same and the greater degree of conversions resulting from the earlier autumn sowing is ascribed to the assimilation of the autumn light.

3662 Truhinova, A. T.
**(The characteristics of winter wheat produced in different climatic regions from the spring wheat Milturum 321).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 238–42. [Russian].

It is pointed out that the winter wheat obtained from conversion of a spring wheat in different localities corresponds to the type of winter wheat grown in and adapted to the region in question. Grain of winter forms obtained from Milturum 321 at Omsk, Moscow and Odessa was subjected to vernalization for different periods and sown on 6 May. Controls without vernalization failed to come into ear. The material from Omsk and Odessa eared after 37–41 days vernalization, whereas that from Moscow eared only after 51 days and was also 8 days later in earing. Under natural conditions, when sown in autumn, the Moscow material took longer to complete its vernalization stage than the other two.

3663 Šimans'kij, M. K.
**(Directed change of spring wheats into winter wheat by training).**
Dopov. Akad. Nauk. Ukrajin. RSR (Proc. Ukrain. Acad. Sci.) 1958 : No. 4 : 452–55. [Ukrainian].

The spring wheats Lutescens 062 and Odessa 13 were vernalized at 2–3° C. and then sown as a winter crop for several generations at Odessa. $F_5$ plants of both varieties changed into winter wheats which showed a high percentage of survival when subjected to temperatures of 21° or 26° below zero.

3664 Marinič, P.
**(New varieties of winter wheats).**
Kolhoz. Proizvod. (Collect. Fm. Prod.) 1958 : No. 7 : 17–18. [Russian].

Descriptions are given of several bread wheats bred at various Soviet institutes. All of them, including the most recent varieties such as Novoukrainka 84 and Bezostaja 4 [Awnless 4] from Krasnodar, have been previously described [cf. XXVI, 2239].

3665 Kiricenko [Kiričenko], F. G.
Grîul de toamnă Odesa 16. **(The winter wheat Odessa 16).**
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 62–70.

[Cf. XXVI, 1181].

3666 Bjaanes, M.
Nora, en ny vårhvetesort fra Møystad. **(Nora, a new spring wheat from Møystad).**
Samvirke 1959 : **54** : 152–54.

Developed at Møystad from Fram II x Sopu [Concord], Nora is as early as its sister variety Norrøna [XXIV, 216] but yields more, has slightly stiffer straw and appears to be more tolerant of bad weather.

3667 **Seed bulletin. Wheat.**
IVRO, Wageningen 1959 : Pp. 12.

Yield data and brief descriptions are given for the chief varieties recommended for growing in the Netherlands. New varieties include: Apollo (Alba x Criewener 192), a winter-hardy winter wheat which yields well, ripens rather late and shows little tendency to sprout in the ear; Bonus (Alba x Carsten V), also winter hardy, with moderately stiff but resilient straw, strongly tillering growth and giving good yields; and the productive spring wheat Jufy (Jubilee x Fylgia), having large plump grain, stiff straw and low susceptibility to sprouting in the ear and described as a good companion crop.

3668 Hristov, J. & Pejčev, S.
**(The physical properties and chemical composition of the more common Bulgarian soft wheats).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 81–94. [Bulgarian].
The grain of 11, 14, 159, 165–V, 301, Sadovka and Åkerman, grown in nine different localities, was examined and a table showing varietal differences in percentage of vitreous grain, specific and hectolitre weights and the content of protein, cellulose, nitrogen-free etherial extract and minerals is presented.

3669 Kamimuro, M. & Takaraman, S.
**(Danchi, a productive wheat for the hot zone).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 989–90. [Japanese].
A description is given of the above variety which was selected in Kyushu from the progeny of Norin 60 [Ministry of Agriculture and Forestry 60] x Seikai 91. It yields well on phosphate-deficient soils in the island of Kyushu.

3670 Korino, Y. & Watanabe, M.
**(Shirasagi wheat).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : p. 556. [Japanese].
A description is given of the above variety which has been bred for suitability for one of the special methods of cultivation practised in Okayama and adjoining areas. It was selected from the cross Shinchucho [New Mid-long] x Kinki 35.

3671 Singh, G., & Dass Gupta, N.
**C. 281 scores over C. 591.**
Indian Fmg. 1959 : **8** : No. 12 : 8–9.
A new strain of wheat, C 281, appears to be more suitable for the comparatively unfavourable conditions of the Punjab than the present recommended variety C 591. It is erect and upright in growth, matures about two weeks earlier than C 591 if sown in the third or fourth week of October and has larger ears with bigger grains. It has a higher yield per acre than C 591. Even under late-sown irrigated conditions C 281 has a higher yield than C 228 which, so far, has been recommended for such conditions.

3672 **Two new wheats for the Northwest.**
Crops & Soils 1959 : **11** : No. 7 : p. 19.
Two improved hard red winter wheats, Columbia and Itana, have been developed, the former for Washington and Oregon and the latter for Washington and Montana. Both are adapted to dryland conditions in Idaho. They are superior to Wasatch, Cache and Turkey in yield, quality and smut resistance and have good milling and baking qualities. They are susceptible to dwarf bunt (*Tilletia controversa*).

3673 Copp, L. G. L.
**Aotea wheat.**
NZ Wheat Rev. 1956–1958 : No. 7 : 75–78.
Details of the agronomic characters and the origin of the above wheat are given [cf. XXVIII, 1367, 1470, 4026].

3674 McEwan, J. M.
**The wheat varieties of New Zealand.**
Bull. NZ Dep. sci. industr. Res. 1959 : No. 131 : Pp. 36.
A short historical review of the wheats grown in New Zealand and an account of characters used in varietal distinction are followed by detailed descriptions of 11 commercial varieties now in use or shortly to be introduced.

3675 Walkden Brown, C.
**Wheat varieties for 1959.**
Agric. Gaz. NSW 1959 : **70** : 85–97.
Varieties are discussed in relation to various problems of wheat production in New South Wales. Descriptions are given of recommended varieties. Notes on varieties suggested for trial sowings are also included. The latter wheats comprise: Dural (Aleppo x Palestine), selected specifically for the production of macaroni-type semolinas of high quality; Heron (parentage given as "R.D.R. x 4 Insignia 49"), similar to Insignia but with the advantage of bunt resistance; Sabre; and Winglen [(Kenya x Gular x Winter Minflor) x (Double Cross x Dundee x Dundee)], a late-maturing dual-purpose wheat [cf. XXVIII, 1507].

3676 Prugar, J. & Kremlička, L.
Studie o technologické hodnotě nové odrůdy pšenice Košutské Ozimé. **(A study of the technological value of the new wheat variety Košutská Ozimá).**
Pol'nohospodárstvo 1958 : **5** : 1227–34.
An account of investigations of the baking and milling properties of Košutská Oximá [Winter Košutská] (Minturki x Bon Fermier), originating from Sládkovičovo, Slovakia, together with the tabulated results of the quality tests, is given. This new high yielding cultivar was superior in technological properties to the high-quality bread wheat Chlumec 12; in particular it made dough that kept fresh longer and its loaf volume was greater.

3677 Šenborn, B., Šenborn, A. & Jelenić, D.
Kvalitet priznatih i novih selekcionisanih sorata pšenice. (**The quality of approved and new wheat cultivars**).
Arh. poljopr. Nauk. 1958 : **11** : No. **34** : 52–66.

In quality studies of the principal varieties of Jugoslav wheats, Bánkút 1201, Bánkút 1205, Kruševac 22 and Beltinci 831 were rated most highly.

3678 Thorpe, H. C. & Dixon, G. E.
**Release of new cereal varieties—1959.**
E. Afr. agric. J. 1959 : **24** : p. 268.

Four wheat selections of Equator x 318AJ4A1 and three of Equator x Kenya Ploughman have been released in Kenya. They have been respectively named Kenya Curlew, Kenya Eagle, Kenya Hawk, Kenya Buzzard, Kenya Dove, Kenya Plover and Kenya Quail. The first five are white grained and the last two red grained. The varieties are suited to altitudes above 7500 ft. Midseason to late in maturity, they have poor baking quality and fair to good strength of straw. During multiplication they have shown a capacity for high yield and a good general level of resistance to most races of stem rust. Since the selections have all given a good performance, they have all been released immediately instead of incurring delay in release through further trials to choose the best.

3679 Arland, A. & Röhlig, E.
Ein Beitrag zum Problem der Sortenberatung auf transpirations-physiologischer Grundlage. (**A contribution to the problem of recommending varieties on a physiological basis in respect of transpiration**).
Z. Acker- u. PflBau. 1959 : **108** : 20–30.

It has previously been shown that the rate of transpiration influences yielding capacity. Experiments are now described showing that light also influences the transpiration of wheat varieties; this factor must therefore be taken into consideration when making physiological tests. The transpiration intensity of turgid plants was shown to be directly proportional to the strength of the light.

3680 Gracza, L.
**Relation between the germination vigour of cereals and the auxin-sensitivity of their coleoptiles.**
Acta agron., Budapest 1958 : **8** : 161–65.

Germinating power, expressed as the time required for the coleoptiles to reach a height of 18–20 mm., was studied in five varieties each of rye, barley, oats and rice. Interspecific differences were greater than intervarietal and the values obtained were inversely related to sensitivity to indole-3-acetic acid.

3681 Karam Singh Nandpuri
**Inheritance of plant height, date of heading and tillering in three wheat crosses.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3814 : p. 647. (Abstr.).

Inheritance of the above three characters and also of the awned condition and kernel colour was determined in Alba x Norin 10 [Ministry of Agriculture and Forestry 10], White Winter x Norin 10 and White Holland x Norin 10. Earliness of heading was partially dominant over lateness and depended on at least two genes, one of which was more effective than the other in leading to earliness. Height appeared to be under the control of a small number of major genes, tallness being partially dominant over shortness. No dominance relationship could be established for tillering from the $F_1$–$F_3$ data. One gene governed awn length. The awnleted condition was dominant over the awned. Inheritance of kernel colour was explicable on the basis of a three-factor hypothesis. The heritability values for heading date, height and tiller number were respectively 93·2, 88·4 and 24·4%. Correlations between generations indicated that selection for heading date and height would be effective in the $F_2$. Associations between heading date, height and tillering were very low. Independent selection for these characters would therefore be feasible.

3682 Vlach, M.
Zjištění posklizňového dozrávání u československého sortimentu ozimých pšenic. (**Ascertaining postharvest ripening in the Czechoslovak collection of winter wheats**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1958 : **31** : 1295–306.

The time required for the grain to ripen after harvesting was determined for a series of winter wheats; this was found to be a varietal character. Marked differences in germination ranging from 0 to 60% were noticed 10 days after harvesting; it is therefore important to know the postharvest ripening period when estimating germinability. Varieties with a short postharvest ripening period are likely to sprout in damp weather.

3683 McEwan, J. M.
**Sprouting in New Zealand wheat varieties.**
NZ Wheat Rev. 1956–1958 : No. 7 : 61–64.

Varieties with red grain have greater resistance to preharvest germination than varieties with white grain, but the reasons for this are not clear. It is possible that the pigment, which is determined by one, two or three genes, may play a part in the suppression of germination. Postripening of the grain may also be of importance. So far, a reliable laboratory test to determine sprouting resistance has not been found.

3684 Černomaz, P. A.
**(Artificial supplementary pollination of winter wheat).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 6 : 46–54. [Russian].

Experiments on wheat varieties conducted under varied climatic and soil conditions in the USSR are discussed. Supplementary pollination increased the number of open spikelets and improved yield, grain set, 1000-grain weight and seed viability.

3685 Batikjan, G. G. & Čolahjan, D. P.
**(Some questions of biology of fertilization in wheat).**
Nauč. Trud. erevan. Univ. (Sci. Rep. Erevan Univ.) 1956 : **54** : 3–30; from Ref. Ž. (Ref. J.) 1958 : No. 9 : Abst. 38064 : p. 33. [Russian].

In studies of pollination in spring and winter wheat varieties, the age of the pistil at the time of fertilization influenced grain setting and the heritable properties of the progeny. The use of a pollen mixture sometimes improved the productiveness of hybrids; supplementary pollination increased grain sets and improved the vitality of the hybrid progeny; intravarietal hybridization + supplementary pollination gave varied results, depending on the particular varieties used.

3686 Larson, R. I. & MacDonald, M. D.
**Cytogenetics of solid stem in common wheat. II. Stem solidness of monosomic lines of the variety S–615.**
Canad. J. Bot. 1959 : **37** : 365–78.

As previously reported, tests of stem solidity in $F_2$ hybrids between the 21 monosomics of Chinese Spring and S–615 indicated that these two varieties differ by at least four genes affecting pith content [cf. 2475]. As no chromosomes were identified in S–615 as carrying genes for solid stem, it was thought that such genes are probably recessive and hence not detectable by the monosomic $F_2$ method when Chinese Spring is the monosomic parent. A study of pith development in monosomic lines of S–615 has therefore been undertaken. Lines of S–615 monosomic for chromosomes III and XVI of homeologous group 3 had culms less solid in the top internode than normal S–615. Monosomics of homeologous group 5, viz. V, IX and XVIII, were less solid in the bottom four internodes than normal S–615. These five chromosomes therefore carry genes for solid stem in this variety. Monosomics XIX, XX and XXI, the D-genome chromosomes of homeologous groups 6, 2 and 7 respectively, were more solid than the normal control in both the top and lower internodes, indicating that the missing chromosomes contain genes for hollow stem. Chromosome XIII, a homeologue of XX, which in Chinese Spring has a gene for hollow stem, did not influence the amount of pith in the culm. In discussing the results, it is pointed out that the concept of dominance or recessivity may in some cases be inadequate to explain inheritance in polyploid wheats, as in the case of solid stem in S–615. When two or three pairs of chromosomes are necessary for either solid or hollow stem, dosage effects are shown if the number of chromosomes is reduced from four to three and from six to five respectively. In a given environment, the amount and distribution of pith are determined by the balance of genes tending to render the stem solid and those promoting hollowness. The loss of any one of the genes tends to produce the opposite phenotype. It is suggested that the interpretation of the culm phenotype on the basis of the interaction of genes with opposite effects makes it possible to reconcile apparently contradictory reports on the genetics of stem solidity to be found in the literature.

3687 Larson, R. I. & MacDonald, M. D.
**Cytogenetics of solid stem in common wheat. III. Culm measurements and their relation to stem solidness in monosomic lines of the variety S–615.**
Canad. J. Bot. 1959 : **37** : 379–91.

Further investigations on the genetics of solid stem in S–615 [3686] showed that most monosomics had shorter culms than normal. Many had thinner culms. Monosomics XIII and XVI, however, possessed thicker culms. The effect of loss of homeologous chromosomes on culm dimensions was generally similar in monosomics of S–615 and nullisomics of Chinese

Spring, but the most extreme member of each homeologous group was not necessarily the same in the two varieties. Differences in solidity between monosomic lines of S–615 and normal S–615 were due to loss of the chromosome affecting pith production and not to secondary effects caused by changes in culm dimensions. Within lines of genetically similar plants, small but consistent associations were however detected between (1) short culm and solidity, (2) thin culm at the tops of internodes I, III and IV and hollowness, and (3) thin culm in the central and lower parts of internode I and solidity. The bearing of these associations upon the interpretation of data in monosomic analysis of solid stem is indicated.

3688 Ivanov, A., Kădrev, T. & Jakomova, Ja.
**(The results of experiments with branching wheat).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 135–60. [Bulgarian].

The soft wheat cultivars 11 and 14 proved superior to branched wheat in most economic characteristics under Sofia conditions, but it is thought that branched wheat may possess some breeding value.

3689 Lelley, J.
Adatok a magyar őszibúza-fajták héjszázalékának vizsgálatához. **(Data on the husk percentage of Hungarian winter wheat varieties).**
Növénytermelés 1958 : **7** : 325–30.

Samples of ten Hungarian winter wheat varieties from five different areas were tested. The percentage of husk to endosperm showed marked varietal and environmental differences. No correlation was found between husk percentage and thousand-grain weight. A correlation was established between the husk percentage and the amount of precipitation between March and June.

3690 Prugar, J.
Technologické vlastnosti bílkovin československých pšenic a možnosti jejich využití v různých odvětvích potravinářského průmyslu. **(Technological characteristics of the protein of Czechoslovak wheats and possibilities of their use in different branches of the provision industry).**
Věd. Práce výzk. Ústav. rostlin. Výrob. 1958 : No. 4 : 53–71.

A detailed report is presented on the protein quality of some Czechoslovak wheats.

3691 Nuret, H. & Schoeffter, J.
Considérations sur les blés français. **(Thoughts on French wheats).**
Bull. Éc. franç. Meunerie 1958 : No. 166 : 153–66.

Observations on the baking quality of a series of wheats are reported.

3692 Casale Buonoconto, B.
Qualità plastiche di alcune cultivar di *Triticum durum* del raccolto 1956. **(Plastic qualities of some varieties of *T. durum* of the 1956 crop).**
Ann. Sper. agr. 1959 : **13** : 5–23.

The grain of 20 cultivars of *T. durum* grown in different parts of Sicily was examined in the Brabender farinograph and the Chopin alveograph and the results are presented. All but one of the varieties widely grown, namely Duro SG3, had indices corresponding to satisfactory quality for making macaroni products. Among the varieties still under test, those with the best indices were 92C, a hybrid of Azizia x Cappelli characterized also by high yielding ability, and some lines of Eiti x Sammartinara Russello x Bidí SG5 and Russello x Bidí SG9.

3693 Kiričenko, F. G.
**(Ways of increasing the production of strong wheats).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 6 : 32–33. [Russian].

The strong wheat Odessa 16 made bread of equally high quality to Ukrainka and as an improver of Voshod [Sunrise] was even superior to it in tests conducted at the Institute of Breeding and Genetics in Odessa. An expansion of the area under Odessa 16 at the expense of Odessa 3, which in recent years has superseded Ukrainka because of its greater hardiness and improved yield and resistance to bunt, is advocated.

3694 Meppelink, E. K.
De bakkwaliteit van de in Nederland verbouwde tarwerassen, oogst 1957. **(The baking quality of the wheat varieties grown in the Netherlands 1957 harvest).**
Sticht. Ned. Graan-Centrum, Wageningen 1958 : 41–58.

Data on baking quality of ten winter and four spring wheats are given. Tests of a number of imported hard wheats showed that these were superior in baking quality to the Netherlands varieties.

3695 Kissell, L. T.
**A lean-formula cake method for varietal evaluation and research.**
Cereal Chem. 1959 : **36** : 168–75.

The evaluation of soft-wheat varieties for cake quality by means of the above method is described. The ingredients of the mixture comprise cake flour, sugar solution, high-ratio emulsified shortening, double-action baking powder and distilled water.

3696 Haertlein, H.
Evolución de la calidad comercial, molinera y panadera de los trigos argentinos frente a las exigencias del mercado interno e internacional. (**The development of commercial, milling and bread-making quality in Argentine wheats with respect to the requirements of the home and international market**).
Rev. argent. Agron. 1958 : **25** : 115–33.

The development of breeding for quality and of state control over varieties for export is surveyed and data on the strength and bread-making and milling qualities of current Argentine varieties are given. Some of the best hard wheats equal Manitoba in strength. In further breeding, gluten quality in semihard wheats and milling quality in all wheats should be improved.

3697 Pumjanskij, A. Ja. & Kartavščikov, F. P.
[**A new micromethod of evaluating the baking quality of wheat varieties at an early breeding stage. (A preliminary report)**].
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 36–38. [Russian].

A method requiring only 15 g. flour for baking three very small loaves has been developed in Leningrad. Testing the quality of wheats in the collection of the Institute of Plant Industry, the grain of which is available only in small quantities, is now possible.

3698 Jakubciner, M. M.
(**The diversity of wheat species in Sinkiang**).
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 58–59. [Russian].

Recent accessions to the collection of the Institute of Plant Industry include forms belonging to *Triticum polonicum*, *T. turanicum*, *T. durum*, *T. aestivum* and *T. compactum*. The following wheats are briefly described. Montane spring forms of *T. polonicum* were found at 1350–1500 m. A new form of var. *levissimum* having no awns was found in cultivation under the varietal name of Gobi in the districts of Lungtai and Shouchang; this form has been named *T. polonicum* var. *gorskii*. *T. turanicum* forms, the first reported from China, were found at Ak-su and Villi at 900–1180 m. They comprise a special endemic group, convar. *montano-stepposum*, and differ morphologically from the common type of *T. turanicum*. *T. polonicum* and *T. turanicum* wheats from Sinkiang are valuable for breeding, as they have exceptionally large grain. *T. durum* comprised spring forms, a cultivar from the region of Baj is mentioned for its long compact ears and highly productive spikelets; this variety is regarded as of quality rare even among the Mediterranean wheats. A great diversity of forms was observed among *T. aestivum*, especially the spring forms. *T. compactum* forms were mostly the same as found in Armenia, the Middle East or Horezm, Central Asia.

3699 Uspenskij, N. A., Kuzina, V. E. & Abramovič, Ju. I.
(**A method of choosing components for intraspecific hybridization of soft spring wheats**).
Zap. voronež. sel'skohozjajstv. Inst. (Notes Voronež agric. Inst.) 1956 : **26** : No. 2 : 88–97 : from Ref. Ž. (Ref. J.) 1958 : No. 7 : Abst. 28579. p. 31. [Russian].

The method is based on choosing parents complementary for yield components. Coefficients for indicating the contribution of single components to yield have been devised. By means of these coefficients, it is possible to evaluate the yield potentialities of different varieties. Graphical methods for analysing yield components are also described.

3700 Bencivenga, R.
Allargare la genetica sul fronte di tutta l'agricoltura. (**Extend genetics on the whole agricultural front**).
G. Agric. 1959 : **69** : p. 143.

Figures cited show that the mean yield of bread wheat in Italy has risen from 13 c. per ha. in 1923–29 to 23·7 c. in 1958. The yields of *Triticum durum* have increased much less and it is suggested that if similar improvements could be effected by breeding in this wheat, in forage plants and in other crops, very considerable benefits would accrue to Italian agriculture.

3701 Hermsen, J. G. T.
**Classification of wheat varieties on the basis of their genotype of necrosis.**
Euphytica, Wageningen 1959 : **8** : 37–46.

On the basis of segregation ratios for semi-lethal necrosis in crosses of Koga with Riebesel and other varieties and in crosses involving Minister, two genetic models are discussed. In one, the four factors *ABCD* are assumed, necrosis being produced by the combinations *AB* and *BCD*, while normal wheats fall into 11 genotypic groups. In the second, necrosis is supposed to be governed by three complementary genes, *ABC*, with seven possible genotypes for normal wheats; an $F_2$ segregation of 9 : 7 may be explained by the presence of one common dominant necrosis factor in the parents. The second model may be tested more easily than the first and is regarded as the more probable.

3702 Medvedeva, G. B.
**(The question of the metabolic influence of the pollen on the progeny).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 150–55. [Russian].

Increases of 3–11·8% in winter survival were obtained by pollinating winter wheat varieties with a mixture of self pollen and winter rye pollen. When pollen of spring rye was used the winter hardiness was reduced in most cases. The spring rye pollen had no effect on the behaviour of the progeny of the winter wheats when sown in spring but when applied to a winter wheat, Lutescens 53, that had been obtained from a spring wheat by conversion it increased the proportion of spring segregates from 10·7 to 35·3%. A pollen mixture from 8 awnless winter wheat varieties added to the self pollen produced a certain number of awnless hybrids when applied to the awned variety Erythrospermum 599; these were discarded and the progeny of the maternal type were examined; they did not differ from the selfed control in plant weight or height. When pollen of *Triticum durum* was used, an increase of 18·9–20 g. in plant weight and 4–7 cm. in height was observed. From both *T. durum* and rye pollen an increase of 17–21% in grain yield was obtained, whereas the pollen mixture from wheat varieties caused a slight reduction.

3703 McEwan, J. M.
**Drought resistance studies in relation to wheat breeding in New Zealand.**
NZ Wheat Rev. 1956–1958 : No. 7 : 57–59.

The possibility of producing a drought-resistant variety is discussed with reference to tests by which a resistant type may be recognized.

3704 Jakubciner, M. M.
**(Wheats with extra short stems and productive ears).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 71–73. [Russian].

An account of testing two forms, originating from Hadmersleben, Germany, under rainfed conditions at Puškin and Krasnodar and under irrigation at Derbent and Taškent is given. Both forms had upright ears, firm short stems and a higher degree of resistance to lodging than the standard varieties at Puškin, Derbent and Taškent. Stem length at Krasnodar was only 25–30 cm. and at the other three localities did not exceed 55 cm., this being less than half the stem length of the standards. Both forms had compact ears 7–8 cm. long and bore oval, semivitreous, large grain. Minor differences between the experimental wheats and the standards in growth periods and disease resistance were observed. Breeding, employing the short-strawed wheats as pollen parents and Pseudomeridionale 122, the standard variety in Taškent, as the seed parent was begun in 1956. The desired character was dominant in the $F_1$. Some $F_2$ plants resembling the seed parent in most respects but having shorter and firmer straw, were selected.

3705 Valdeyron, G., & Seguela, J.-M.
Étude bibliographique et expérimentale sur le mitadinage. **(A bibliographical and experimental study on mealy endosperm).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 291–328.

The above disorder appears to result from a deficiency in nitrogen supply. It was found that varietal differences in susceptibility to this condition could be determined by growing plants in boxes and cutting off their nitrogen supply just after earing, the nitrogen being formerly supplied in a nutrient solution. Varieties which require a good supply of nitrogen for the grain to become vitreous are susceptible to mealy endosperm. Of the varieties tested, Zenati x Bouteille [Bottle], Bidi 17 and D117-Mahmoudi x M'Rari 118 are resistant.

3706 Takegami, S.
**(Analysis of injury to wheat ears caused by *Gibberella zeae* and inter-varietal differences).**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 235–37. [Japanese].

Experiments involving eosin movement up the culms of wheat ears which had been infected with *G. zeae* enabled a distinction to be drawn between direct damage caused by the fungus and spikelet withering due to interference with water movement up the rachis by an infected spikelet lower down. A comparative study of six varieties showed that resistance is associated with a more rapid initial spread of the pathogen along the rachis. This rapid spread brings about a water deficit in the ear and so creates unfavourable conditions for the further development of the pathogen.

3707 Block, G.
Untersuchungen über die Braunfleckigkeit (Spelzenbräune) des Weizens (*Septoria nodorum* Berk.), insbesondere in bezug auf Infektionsbedingungen, Sortenanfälligkeit und wirtschaftliche Bedeutung des Pilzes. [**Investigations on glume blotch of wheat (*S. nodorum* Berk.), especially in relation to the conditions of infection, varietal susceptibility and economic importance of the fungus**].
Z. Acker- u. PflBau. 1959 : **107** : 435–58.

The results are reported of tests carried out with a large number of winter and spring wheats in four districts in Upper and Lower Bavaria during 1954–1956. Marked differences in susceptibility to *S. nodorum* (*Leptosphaeria nodorum*) were noticed; in general the late-ripening varieties suffered more than the earlier ones. Also varieties originating from northern Germany were more susceptible than those native to southern Germany. Several spring wheats were completely free of the disease.
Attempts were made to develop a rapid method of determining the resistance of wheat varieties. The method involves placing green ears in a test tube with a 10 ml. suspension of spores; the mixture is shaken up and then left for two days after which most of the spore suspension is poured off. The test tubes are then placed in an upright position in covered glass containers in the light; the containers hold some water in order to keep the atmosphere damp. After 10 days the severity of the disease can be judged. It is thought that with some improvement this method may be of use to the breeder.

3708 Rod, J.
Geneticko-fyziologická studie rezistence pšenic proti sněti prašné. III. Závislost rezistence proti sněti prašné na některých vnitřních a vnějších faktorech. (**A genetical and physiological study of resistance of wheat to loose smut. III. The dependence of resistance to loose smut upon some internal and external factors**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 317–44.

Resistance studies of artificially infected spring and winter wheats at Pohořelice showed that the percentage of diseased plants in harvested plants was the most reliable guide to the degree of resistance of a variety. It does not depend noticeably on meteorological conditions nor is it upset by what are referred to as "internal factors", namely, the survival of infected plants or ability of the plants to set and form grains after infection.

3709 Warmbrunn, K.
Prüfung des deutschen Weizensortiments auf Widerstandsfähigkeit gegen Zwergsteinbrand (*Tilletia controversa* Kühn). [**Testing the German varietal collection for resistance to dwarf bunt (*T. controversa* Kühn)**].
Angew. Bot. 1959 : **33** : 1–9.

The German collection of varieties was tested during 1954–57 in five localities. No variety was completely resistant, but Graf Toerring II [Count Toerring II], Erbachshofer Braun [Erbachshof Brown], HS Burgweizen [HS Castle wheat] and Wahrberger Ruf [Wahrberg Fame] were relatively resistant, followed by Heges früher [Hege's Early] and Karat.

Aktuelle Fragen auf dem Gebiet der Brandforschung. Ergebnisse der Tagungen der Fachgruppe Brandkrankheiten der Arbeitsgemeinschaft für Krankheitsbekämpfung und Resistenzzüchtung bei Getreide und Hülsenfrüchten in Giessen am 29.11.1957 und in Straubing am 20.6.1958. (**Current questions in the field of smut research. Results of the Sessions of the Technical Group for Smut Diseases of the Working Party for Disease Control and Resistance Breeding in Cereals and Leguminous Crops in Giessen on 29.11.1957 and in Straubing on 20.6.1958**).
Prakt. Bl. PflBau 1958 : **53** : 207–59.

3710 *Schuhmann, G. Vorversuche zum Auftreten physiologischer Rassen des Weizensteinbrandes* (Tilletia tritici [*Bjerk.*]

*Winter*). [*Preliminary tests on the occurrence of physiological races of wheat bunt* (T. tritici [*Bjerk.*] *Winter*)]. (*pp. 215–17*).
Fourteen German winter wheats were infected with 10 samples of *T. tritici* from different regions in Federal Germany. Wahrberger Ruf was the most resistant variety, being unattacked by six samples. Six races of the pathogen were distinguished, five differential varieties being used. Using nine of the bunt samples, 11 German spring wheats were also infected in a field trial; marked differences in varietal susceptibility were observed and four races distinguished. In a further test using only one wheat variety, differences in pathogenicity between the samples of *T. tritici* were noticed.

3711 *Wagner, F. Infektionsversuche mit Zwergbrandherkünften des Weizens.* (*Infection tests of wheat with sources of dwarf bunt*). (*pp. 225–26*).
Tests of 10 wheat varieties with samples of *T. controversa* from eight localities in Bavaria gave no indication of the existence of physiological races of the pathogen.

3712 *Schuhmann, G. Stellungnahme zur Aufstellung eines Testsortimentes zur Klärung der Rassenfrage bei Zwergsteinbrand.* (*A criticism of the setting up a test collection for clarifying the racial question in dwarf bunt*). (*pp. 226–27*).
Mention is made of German and foreign wheats which have shown some resistance to dwarf bunt. In tests using artificial infection, Breisgauer roter Landweizen [Breisgau Red Land Wheat] had 2% of the stems diseased and Relief, an American variety, had 0%. Also mentioned are American varieties carrying major genes for resistance to *Tilletia* spp.; some minor resistance genes are also known. Current work should be concentrated more on testing resistant wheats with as many sources of bunt as possible than on setting up a set of differential varieties.

3713 Kendrick, E. L. & Purdy, L. H.
**A seedling reaction of wheat indicative of bunt infection.**
Phytopathology 1959 : **49** : 130–32.
A characteristic chlorotic flecking was observed on the leaves of the spring wheat Red Bobs infected with *Tilletia caries* or *T. foetida*; the flecking was detectable from the three or four leaf stage up to maturity. Susceptible winter wheats have also shown flecking on the seedling leaves after infection; other highly resistant varieties did not show this reaction. It therefore seems possible that the seedling reaction may be used in screening winter varieties for resistance.

3714 Johnson, A. G.
**Further studies of physiologic races in *Urocystis tritici*.**
Phytopathology 1959 : **49** : 299–302.
Seeds of 33 wheat varieties were inoculated with flag smut (*U. tritici*) from Chile, Australia, South Africa, Japan, India, China and the USA. The smut from Chile was the same as USA race 2 while that from Australia was more virulent and has been considered a separate biotype, race 2A. The smut from South Africa differed slightly from USA race 2 and so has been called race 2B. The Japanese smut has been considered a distinct biotype, race 3, and the Indian smut has been designated race 4. The Chinese races C1 and C2 are fairly similar to USA race 1, but the other Chinese races differed in various respects from all the other collections.

3715 Futrell, M. C., Lahr, K. A., Porter, K. B. & Atkins, I. M.
**Second stripe rust epiphytotic in Texas hits wheat crop in 1958.**
Plant Dis. Reptr. 1959 : **43** : 165–67.
The responses of hard red winter wheats to *Puccinia glumarum* in Texas are tabulated. A number of varieties derived from Turkey showed good resistance.

3716 Miller, J. D. & Christensen, J. J.
**Occurrence of stripe rust in Minnesota in 1958.**
Plant Dis. Reptr. 1959 : **43** : p. 159.
*Puccinia glumarum* is recorded for the first time in Minnesota on common wheat and durum varieties. The only uninfected varieties found on otherwise heavily infected plots were Sentry, Ramsey and Towner.

3717 Pady, S. M. & Johnston, C. O.
**Stripe rust in Kansas in 1958.**
Plant Dis. Reptr. 1959 : **43** : 159–62.
*Puccinia glumarum* was widespread in Kansas in 1958. The most resistant wheat varieties were found to be: Turkey CI1558, Kharkof CI1442, Cheyenne CI8885, and Harveyland CI13364 (Iowin).

3718 Gough, F. J., Williams, N. D. & Brentzel, W. E.
**Occurrence of stripe rust in North Dakota in 1958.**
Plant Dis. Reptr. 1959 : **43** : 169–71.
Reactions of 34 wheat varieties to *Puccinia glumarum* are listed. On more than half of these there was no leaf necrosis and on several others traces only.

3719 Bridgmon, G. H. & Kolp, B. J.
**Stripe rust in Wyoming in 1958.**
Plant Dis. Reptr. 1959 : **43** : 163–64.
The following varieties were found to be resistant to *Puccinia glumarum* in Wyoming in 1958: Thatcher, Selkirk, Lee, Rushmore, K338AA x N2350 and Thatcher[6] x Kenya Farmer. Stem-rust infection was absent in Towner, Ramsey and Yuma.

3720 Lukianenko [Luk'janenko], P. P.
Aplicarea metodelor miciuriniste în selecția grîului de toamnă. (**The application of Mičurinist methods in breeding winter wheats).**
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 48–61.
[Cf. XXVI, 2239].

3721 Kataraki, B. H., & Banahatti, A. L.
**Breeding rust resistant varieties of wheat for northern districts of Mysore State.**
Mysore agric. J. 1958 : **33** : 127–29.
Several rust-resistant hybrids with good agronomic qualities have been produced by crossing Gaza with high-yielding local varieties.

3722 Zadoks, J. C.
**Preliminary report on the "Yellow Rust Trials Project" in 1958.**
Tech. Ber. Sticht. Ned. Graan-Centrum 1959 : No. 2 : Pp. 16 + tables + maps + 7. (Mimeographed).
A further report of this cooperative project in several European countries [cf. XXVIII, 4088] gives information on the degrees of infection affecting 24 spring and winter wheats and the spring barley Heine FR9 and on physiological races.

3723 Hassebrauk, K.
Zur physiologischen Spezialisierung des Weizenbraunrostes (*Puccinia recondita* Rob. = *P. triticina* Erikss.) in Deutschland und anderen europäischen Staaten im Jahre 1957. Kritische Bemerkungen zur Methodik der Rassenbestimmungen. [**The physiological specialization of brown wheat rust (*P. recondita* Rob. = *P. triticina* Erikss.) in Germany and other European states in the year 1957. Critical remarks on the methods of race determinations**].
NachrBl. dtsch. PflSchDienst., Stuttgart 1959 : **11** : 43–45.
Samples from 138 localities were tested. Race 17 occurred in 70% of these places and race 52 in 60%; nine other races were found. Several races occurred in two different biotypes. The need for a new set of differential varieties for determining races is emphasized. Some of the old test varieties are no longer genetically pure and the reaction to brown rust races is in some cases greatly influenced by external conditions.

3724 Basile, R., Leonori-Ossicini, A. & Zitelli, G.
Identificazione di razze fisiologiche di *Puccinia rubigo-vera tritici* (Erikss. et Henn.) Carl. (= *P. triticina* Erikss.) isolate da campioni provenienti da varie regioni d'Italia (Anni 1953, 1954 e 1955). [**Identification of physiological races of *P. rubigo-vera tritici* (Erikss. et Henn.) Carl. (= *P. triticina* Erikss.) isolated from samples coming from different regions of Italy (1953, 1954 and 1955)**].
Boll. Staz. Pat. veg., Roma 1958 : **16** : 1–12.
[Cf. XXVIII, 4091].

3725 Basile, R., Leonori-Ossicini, A. & Zitelli, G.
Specializzazione fisiologica di razze di ruggini dei cereali isolate da materiale italiano raccolto durante l'annata 1956. *Puccinia recondita* Rob. ex Desm. [= *P. rubigo-vera* (D.C.) Wint. f. sp. *tritici* (Erikss.) Carl.]. (**Physiological specialization of cereal rust races isolated from Italian material collected in 1956. *P. recondita* Rob. ex Desm. [= *P. rubigo-vera* (DC.) Wint. f. sp. *tritici* Erikss.) Carl.**]).
Boll. Staz. Pat. veg., Roma 1958 : **16** : 13–18.
[Cf. 1417].

3726 Thorpe, H. C.
**Cereals in Kenya : 1956–57.**
K.I.O. Fortn. 1956 : No. 404 : 3–5.
A new stem-rust race, K15, and a suspected new race, K16, have been isolated. The variety Canadian Regent and the Kenya wheat 354 and 321 have shown promise with respect to rust resistance; the first-mentioned was, however, susceptible to glume blotch. Notes on recommended wheats, barleys and oats are included, together with a table giving information on straw strength, maturity period, baking quality and altitudinal range.

3727 Campos, A.
**The importance of stem rust races in relation to the production of rust resistant wheats for Mexico.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7417 : p. 1904. (Abst.).

Stem-rust resistant wheats from different parts of the world were evaluated for disease reactions and agronomic qualities in the wheat area of Mexico. The best introduced wheats were crossed with local wheats. Seedling and adult reactions to *Puccinia graminis* var. *tritici* races 11, 15B, 29, 48, 49, 125 and 139 from Mexico and 15B from Maryland were determined in greenhouses and adult reactions were also studied in the field. The native parents Aguilera, Candeal, Pelón Colorado [Red Awnless] Colorado Bajío [Bajío Red] and Marroqui 588 were susceptible to all the rust races and Barrigón Yaqui [Yaqui Pot-bellied] and Barrigón Zamora [Zamora Pot-bellied] had seedling resistance to 3 or 4 races and adult resistance to more races. The introduced varieties were each resistant to different races of rust though several had excellent seedling resistance to all isolates, Kenya Farmer being among the best. Eight hybrids, subsequently named Cajeme 54, Cajeme 54A, Gabo 54, Gabo 54A, Mayo 54, Yaktana 54, Yaqui 53A and Kentana 54, were valuable for their resistance to all eight rust isolates.

A series of wheats were also studied in Minnesota where variability in reaction was observed at different greenhouse temperatures. Rust races 11, 29, 48A, 49 and 139 from Mexico and 15B from Minnesota were used. Yaqui 53 and Yaqui 53A were outstandingly resistant to these isolates; Cajeme 54, Cajeme 54A, Gabo 54 and Gabo 54A were resistant to four races and had temperature-sensitive reactions to Minnesota 15B. There were pathogenic differences between the races used in the two places, particularly races 11, 48, 49 and 139, and biotypes of these races certainly exist in Mexico. Races 11, 29 and 48 were more aggressive on improved wheats than the other races and probably have the greatest potential danger.

3728 Bridgmon, G. H.
**Production of new races of *Puccinia graminis* var. *tritici* by vegetative fusion.**
Phytopathology 1959 : **49** : 386–88.

New virulent races of *P. graminis* var. *tritici* have been produced by mixing uredospores that were distinct in colour and pathogenicity in distilled water and injecting them into different varieties of wheat in the late boot stage of growth. When races 11 and 121, with orange and grey-brown uredospores respectively, were mixed, at least 15 different red races and biotypes differing from the parents in colour and pathogenicity were obtained, which is more than expected from simple nuclear reassortment. When race 9 was mixed with the grey-brown race 11 only one red race, a biotype of 15, was isolated. Usually each new race approached the pathogenicity of one of the parent races. In a few instances, increases or decreases in pathogenicity were noted.

3729 Lu, S.-I. & Lee [Li], K.-C.
**(The effect of light and temperature on varietal resistance of wheat to *Puccinia glumarum*).**
Chih-wu Ping-li-hsueh Pao (J. Pl. Path.)/ Acta phytopath. sin. 1958 : **4** : 129–36. [Chinese].

The reactions of a set of Chinese varieties to four physiological races of the pathogen were determined over a range of light and temperature conditions. There was a tendency for resistance to increase with temperature, and the critical temperatures at which some susceptible varieties became resistant were noted. The effects of light were less predictable. Race $Y_{6B}$ causes severe damage to the recently introduced variety Pi-ma 1. Varieties resistant to this race include Tsao-yang [Early Foreign], Chin-ta 4197, Li-yung 1 and Nung-ta 6 [Agricultural University 6].

3730 Lu, S.-I. *ET AL.*
**(Studies on *Puccinia glumarum* affecting wheat and grasses).**
Chih-wu Ping-li-hsueh Pao (J. Pl. Path.)/ Acta phytopath. sin. 1958 : **4** : 137–44. [Chinese].

Samples of the above species collected from *Elymus chinensis* were not pathogenic to wheat. However, collections from *E. sibiricus* and *Agropyron* spp. were severely pathogenic to some wheat varieties.

3731 Omar, A. A. M. ['Umar, 'A. ul 'A.].
**Inheritance of reaction to race 15 B and some other races of stem rust of wheat.**
Egypt. J. Bot. 1958 : **1** : No. 1 : 1–17.

Investigations were carried out at the Faculty of Agriculture, Ain Shams University, Egypt, to determine the inheritance of (1) field reaction to an artificial epiphytotic of 66 races, including

15B, and (2) seedling reaction to race 15B in the greenhouse at high temperature (80–85° F.), using 24 crosses involving 12 spring wheats. Inheritance of (1) was interpreted as depending on genes at two complementary loci, *R* and *S*. Three alleles occur at the former locus, *R*, $R^1$ and *r*. *RS*, $R^1S$, *Rs* or *rS*, and $R^1s$ or *rs* are respectively responsible for resistance, moderate resistance, moderate susceptibility and susceptibility. Inheritance of (2) was controlled by genes at two loci, *T* and *W*. Four alleles were detected at the former locus, *T*, $T^1$, $T^2$ and *t*. Factor *T* was epistatic to *W*. *TW*, $T^1W$, $T^2W$, *tW* and *tw* respectively resulted in immunity, resistance, moderate resistance, moderate susceptibility and susceptibility. The parental varieties were found to possess the following genotypes: Egyptian x Frontana selection, *RRSS*, *ttWW*; Egyptian NA95, *RRSS*, $T^2T^2ww$; Egyptian NA101 $R^1R^1ss$, $T^2T^2ww$; Kenya 58, *RRss*, $T^1T^1ww$; Kenya 117A, *RRss*, $T^1T^1ww$; Kentana, *RRSS*, *TTww*; Marquis, *RRSS*, $T^2T^2ww$; Timstein x Henry selection, *RRSS*, *ttww*; Lee, *rrSS*, *ttww*; Lerma, *rrSS*, *ttww*; Mida, $R^1R^1SS$, *ttww*; and Thatcher, *rrSS*, *ttww*. Inheritance of (1) and (2) were independent in most crosses, only Egyptian NA101 x Lee and Egyptian NA101 x Thatcher giving indication of an association.

3732 Watanabe, Y.
**(The breeding of disease resistant wheat by interspecific and intergeneric crossing).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1447–50, 1593–98. [Japanese].

Most of this article is taken up with a review of physiological specialization in the rusts, the various types of resistant reaction, sources of resistance in *Triticum* spp. and related genera, interspecific and intergeneric hybridization to obtain rust-resistant segregates and cytological problems involved in such work. The final section deals mainly with the author's own studies on rust-resistant amphidiploids which have been reviewed *passim* in *Plant Breeding Abstracts*.

3733 Hassebrauk, K.
Beiträge zum Resistenzproblem bei den Getreiderosten. **(Contributions to the resistance problem in cereal rusts).**
Wiss. Z. Martin-Luther-Univ. Halle-Wittenberg 1958 : **8** : p. 49.

Investigations of the respiratory metabolism of wheats differing in susceptibility to *Puccinia triticina* are discussed [cf. XXVII, 3945]. Resistant wheats have a higher general metabolic activity than susceptible ones. The supply of suitable carbohydrates and nitrogen compounds in the host affects the reproduction of the pathogen. Resistance symptoms may depend on other metabolic factors such as the content of polyphenols and ascorbic acid; the factors determining the type of infection differ according to the type of host and rust involved.

3734 Lyles, W. E., Futrell, M. C. & Atkins, I. M.
**Relation between reaction to race 15B of stem rust and reducing sugars and sucrose in wheat.**
Phytopathology 1959 : **49** : 254–56.

Reducing sugars were determined at three stages of growth for four varieties of wheat, Minnesota II–50–17, Khapli, Hard Federation and Nugget, treated and untreated with maleic hydrazide. The first two varieties are resistant and the last two are susceptible to race 15B of stem rust (*Puccinia graminis* var. *tritici*). In a second experiment, two pairs of "isogenic lines" from Newthatch-Frontana x Renacimiento-Kenya, resistant and susceptible to race 15B, were analysed for carbohydrate fractions. In the first experiment, a high level of soluble carbohydrates, especially reducing sugars, appears to be strongly associated with resistance to race 15B of stem rust, as reducing sugars are higher in the 15B-resistant varieties than in the susceptible ones. In the second experiment, though rust resistance cannot be attributed to the effect of any single condition, the resistant line of each pair of isogenic lines had a higher reducing sugar content than its corresponding susceptible line. Untreated Minnesota II–50–17 had the greatest amount of reducing sugar in all three stages of growth and was the most rust-resistant variety studied.
Maleic hydrazide treatment significantly decreased reducing sugars in Khapli and Minnesota II–50–17 and significantly increased them in Hard Federation and Nugget, but the sugar content of these susceptible varieties did not reach the level of the untreated Minnesota II–50–17. The decrease in reducing sugars caused by this treatment was accompanied by an increase in susceptibility to race 15B of stem rust in Khapli and in Minnesota II–50–17, but particularly in the former.

3735 Gorja, V. S.
**[Studying a new collection of soft wheats introduced by the Institute of Plant Industry for resistance to diseases under conditions in the Kuban' and at Derbent. (The problem of initial material)].**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 8–15. [Russian].

Many wheats introduced from different countries have been tested for resistance to *Puccinia graminis*, *P. triticina* and *Erysiphe graminis* in Dagestan and the Kuban', varietal differences in resistance being noted. The highest proportion of resistant varieties, including wheat with combined resistance to rust and mildew, was found among Argentine material. Other wheats characterized by combined resistance originated from Canada, China, Czechoslovakia, Uruguay, the USA and Jugoslavia. A table lists 28 varieties rated highly for combined resistance and provides additional information on ear characteristics, dates of wax ripeness, lodging resistance and 1000-grain weights under conditions in Dagestan.

3736 Écochard, R., & Mansat, P.
Une sélection massale est-elle applicable à la recherche d'un blé tendre peu sensible au piétin-verse? **(Is mass selection applicable to the search for a wheat less susceptible to foot rot).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 329–38.

*Cercosporella herpotrichoides* hinders the development of wheat grains; infected grains appear withered and are less heavy than healthy grains. It is therefore possible by mechanically sorting out the plump grains to select the most resistant genotypes in a hybrid population infected with the pathogen. This type of mass selection has been used successfully at Versailles with the cross (90–2X Étoile de Choisy) 2–7 x Cappelle-Desprez; in this cross only one parent, Cappelle-Desprez, has some resistance to *C. herpotrichoides*. It was found necessary to continue the mass selection for several years to obtain a satisfactory improvement in resistance.

3737 Smith, H. C.
**Yellow-dwarf virus of wheat.**
NZ Wheat Rev. 1956–1958 : No. 7 : 51–56.

Preliminary surveys showed that yellow-dwarf virus was widespread throughout New Zealand on wheat, oats and barley. During investigations to find a resistant wheat variety, Cross 7, Tainui, Hilgendorf, Solid Straw, Tuscan, Hunters, Dreadnought, Yielder and Fife-Tuscan proved to be susceptible though the last appeared to have some resistance. Arawa, Aotea and Cabo have also been infected with the virus. So far no immune varieties have been found.

3738 Nakagawa, M., Soga, Y., Okazima [Okajima], N., Yoshioka, A. & Nisimata [Nishimata], D.
**(Genetical studies on wheat mosaic virus. I. Genes controlling the manifestation of green mosaic virus in wheat).**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 169–70. [Japanese].

The genetics of reaction to the above virus was studied in the $F_0$ and $F_2$ generations of crosses involving the resistant varieties Shinchunga [New Mid-long] and Kumamoto and the susceptible varieties Sanshukochiku and Hatakeda, grown under conditions of natural infestation at Sakurai in the prefecture of Nara. It is concluded that three loci with multiple alleles are concerned, with $A > A_1 > A_2$, $H > H_1$ and $M > M_1 > M_2$. The $H$ and $M$ alleles determine susceptibility; the $A$ alleles inhibit $H$. The genetic constitutions of the varieties mentioned above are believed to be $A_1hM_1$, $AhM_2$, $A_2H_1m$ and $aHM$ respectively.

3739 Stryckers, J.
L'influence d'un traitement au DNC sur la résistance au froid des variétés de céréales. **(The influence of DNC treatment on frost resistance of cereal varieties).**
Rev. Agric., Brux. 1958 : **11** : 1323–29.

Results from the Netherlands and Belgium show that treatment of winter-cereal fields in winter with dinitro-o-cresol kills the weeds and so increases the yield. However, it has been found in several varieties of wheat, spelt, rye and particularly barley that winter treatment with DNC increased their susceptibility to frosts.

3740 Morozova, Z. A.
**(The after-effect of short day upon organogenesis in wheat).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 7 : 139–41. [Russian].

The progeny of wheat subjected to 9 hr. photoperiods for 15 days had its heritable basis shattered, as could be seen from changes in such morphological characters as ear length, number of spikelets and grains formed per ear. Short-day treatments lasting longer than 15 days

reduced the vitality of the progeny. The use of photoperiodic treatment as an auxiliary method in plant breeding is recommended.

3741 Špaldon, E. & Láskoš, J.
**(A contribution to the technique of the vernalization of Slovakian winter wheat).**
Sborn. vysok. Škol. pol'nohospod. Nitre : Agron. Časť. : Ser. A. : 1957 : **1** : 33–51.

The vernalization requirements of seven varieties of *Triticum vulgare* and eight strains of *T. durum* are described; some *T. durum* strains behave like spring wheat for they require only a short vernalization period.

3742 **New short wheats show promise in Texas tests.**
Crops & Soils 1959 : **11** : No. 9 : p. 20.

At the Texas Agricultural Experiment Station, a cross between a Japanese dwarf wheat and hard red winter varieties has been produced which grows to a height of 25 to 35 in. In tests conducted near Amarillo, the best strain of short wheat yielded 75 bushels per acre as compared with 54 bushels from Concho and Wichita. At Denton, semidwarf strains yielded 20 bushels per acre more than commercial varieties. Short wheats have the advantage that higher levels of fertilizer may be applied without danger of lodging and also these wheats appear to be more efficient in the use of fertilizer, giving an increased yield of grain without excessive straw production.

3743 Kihara, H. & Tanaka, M.
**(Morphological and physiological variation among *Aegilops squarrosa* strains collected in Pakistan, Afghanistan and Iran).**
Preslia 1958 : **30** : 241–51.

A collection of 176 strains of *Ae. squarrosa* was made in these countries; these strains were grown in experimental fields at Kyoto and Mishima. Two subspecies, *squarrosa* and *strangulata*, were clearly distinguished; *Ae. squarrosa* ssp. *squarrosa* has three known varieties. *Ae. squarrosa* ssp. *strangulata* is only found in a narrow stretch of the south-east coast of the Caspian Sea.

A considerable amount of morphological variation was found among the strains; this concerned plant height, growth habit, seedling colour and other characters. Only strains collected from wheat fields had characters such as erect culms and large grains which are found among cultivated wheat. Also variation in physiological characters such as maturity period and rust resistance was observed. Some strains of *Ae. squarrosa* ssp. *squarrosa* var. *meyeri* and spp. *strangulata* showed resistance to *Puccinia triticina* and *P. graminis* f.sp. *tritici*; both these forms of *Aegilops* grow in humid areas.

Crosses were made between strains from eight different regions. Other crosses were effected between three old strains, which had been maintained at Kyoto for a number of years, and eight strains of the new collection. All the $F_1$ hybrids showed normal meiosis with seven bivalents. In most cases fertility was normal but one of the old strains gave rise to many sterile hybrids. Sterility in the crosses is thought to depend partly on the genotypes of the parents and partly on the environmental conditions. The strains also differed with respect to the morphology of a SAT chromosome. [Cf. XXVII, 420 and XXVIII, 4117].

## BUCKWHEAT

3744 Sal'nikov, V. K.
**(Vegetative hybridization of buckwheat).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 39–45. [Russian].

[Cf. XXVIII, 2876].

3745 Krotov, A. S.
**(Evaluating buckwheat varieties for the tendency to shed).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 16–18. [Russian].

Three Ukrainian varieties were superior in resistance to shedding to all other cultivars tested at the Ustimovskaja Research Station, Poltava province. Plants with improved resistance to shedding also occurred among some Ukrainian standard varieties and are thought to provide useful material for selection.

3746 Tatebe, T.
**(Physiological studies on fertility in buckwheat. VI. An investigation of the mechanism of heterostyly).**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 149–54. [Japanese].

Bud pollen was inferior to normal pollen in fertilizing capacity. Immature and old pistils showed no improvement in self-fertilization capacity over pistils of normal maturity. Self fertility was not enhanced by treatment with 0·01% boric acid. These observations show that the mechanism of heterostyly proposed by Moewus for *Forsythia* [XXIII, 1674] does not apply to buckwheat. [Cf. XXVII, 2845].

3747 NAGATOMA, T.
**(Studies on breeding buckwheat. I. Floral arrangement and flowering habit).**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 238–46. [Japanese].
Flowering habit is described, differences between summer and autumn strains being noted.

3748 ŠUSTOVA, A. P.
**(Determining the termination of the light phase of development in buckwheat).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 50–56. [Russian].
In studies of photoperiodism at Puškin, differences in response to short days were observed between (1) Aleksandrovskaja 134, Amur and Tetraploidnaja [Tetraploid] and (2) Korean, Japanese and Chinese forms of buckwheat. The former group showed reduction, the latter an increase in the number of inflorescences and fruits developed and in fruit weight per plant. Changes occurred in the shape of the grains in Aleksandrovskaja 134 and Amur and their progenies in some experiments where the plants were transferred from long to short days or *vice versa*.

## OATS

3749 BLAND, B. F.
**Spring oat variety trials, 1952–57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 297–309.
This report on 14 British and continental varieties summarizes the information obtained from 89 trials in England, Scotland and Wales, with Sun II as control. None of the varieties showed any substantial advantages over Sun II.

3750 BEESLEY, D. W., & BURRELL, W. D.
**N.A.A.S./N.I.A.B. spring oat variety trials, 1952–54.**
J. nat.Inst. agric. Bot. 1958 : **8** : 310–21.
None of the newer commercial varieties entered in the 113 trials carried out in England and Wales by the National Agricultural Advisory Service in cooperation with the National Institute of Agricultural Botany had any substantial advantage over the control Sun II.

3751 BEESLEY, D. W., & BURRELL, W. D.
**N.A.A.S./N.I.A.B. spring oat variety trials, 1955–57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 322–32.
Sixty-four trials of commercial varieties conducted in England and Wales are reported. As in the earlier tests, no variety was superior to Sun II [cf. 3750].

3752 ELLIOTT, C. S.
**Winter oat variety trials 1952–56.**
J. nat. Inst. agric. Bot. 1958 : **8** : 333–41.
Information is given on the performance of Penrhyn [cf. 3607] and Powys [cf. XXVII, 448] in England and at one Scottish centre, in comparison with S147 and S172. Data are also included on eight experimental selections. Compared with S147, Penrhyn was substantially higher in yield, more resistant to mildew, four or five days later in ripening and only slightly inferior in grain quality and resistance to lodging and winter conditions. Powys equalled S147 in yield, winter hardiness and mildew resistance, ripened two days earlier and was more resistant to lodging. It bore smaller grains than S147 but was similar in kernel content.

3753 Forsøg med havresorter 1955–1958.
**(Trials of oat varieties, 1955–58).**
Tidsskr. Frøavl 1959 : **24** : 129–32.
Details are given of the performance of nine varieties tested on different soil types in Denmark. Marne gave the highest yields on ordinary soils and on high and low bog soils and gave average yields on marsh soils.

3754 LUK'JANOVA, M. V.
**(The best oat varieties for green fodder in the north-west of the USSR).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 141–44. [Russian].
A form of *Avena strigosa* and the cultivars Pobeda [Victory] and Gigant Bogemskij [Bohemian Giant] exceeded the standard Zolotoj Dožd' [Golden Rain] in hay yield and dry-matter content in recent trials at the Institute of Plant Industry. The Norwegian variety Nidar also outyielded the standard and provided highly nutritious fodder after early sowings. Gigant Bogemskij is referred to as resistant to crown rust.

3755 GRIFFITHS, D. J., ROWLANDS, D. G., & PEREGRINE, W. T. H.
**Cytogenetic relationships of certain artificial and natural species of *Avena*.**
J. agric. Sci. 1959 : **52** : 189–99.
At the Welsh Plant Breeding Station, Aberystwyth, a study was made of $F_1$ hybrids of the 6*x* amphidiploid *A. barbata* x *A. strigosa* ssp. *hirtula* with *A. sativa*, *A. byzantina*, *A. nuda*, *A. fatua* and *A. sterilis* and with the 6*x* amphidiploids Cc4387 (*A. abyssinica* x *A. strigosa*) and 240Cx (*A. barbata* x *A. longiglumis*). Like *A. fatua*, amphidiploid *A. barbata* x *A. strigosa* had pubescent grain, a geniculate awn on the dorsal

side of the lower and upper grains and the articulate type of separation of the spikelet from the peduncle and of floret disjunction. Apart from their sterility, hybrids between the amphidiploid and *A. fatua* did not differ in spikelet morphology from their parents. In hybrids between the amphidiploid and *A. sterilis* or *A. byzantina*, the fracture type of floret disjunction characteristic of both these species was completely dominant. In hybrids from crosses of the amphidiploid with *A. sativa* and *A. nuda*, separation of the spikelet from the peduncle by fracture, as in the two last-mentioned parents, was partially dominant. These hybrids also had upper grains with the nonshedding type of base. In the cross with *A. nuda*, naked caryopsis and multiflorous spikelet were recessive. The wild types of separation of the spikelet from the peduncle and of floret disjunction were dominant in amphidiploid (*A. barbata* x *A. strigosa*) x Cc4387. *A. barbata* x *A. strigosa* amphidiploids had a mean univalent frequency of about 2 and bivalent frequency of 14. Multivalents, chiefly trivalents and quadrivalents, were also seen. Cc4387 and 240Cx were essentially similar to this amphidiploid in meiotic behaviour. Hybrids between amphidiploid *A. barbata* x *A. strigosa* and the hexaploid species had mean frequencies of $12_{I}$ and $8_{II}$. Pairing in the amphidiploid x amphidiploid combinations was similar to that observed in their immediate parents, except for slightly fewer univalents and a somewhat higher frequency of quadrivalents. Seed set in amphidiploid *A. barbata* x *A. hirtula* ranged from 20 to 70%, with a mean of 40%, and was lower in Cc4387 and 240Cx. Amphidiploid x amphidiploid combinations were comparable in fertility to the 6*x A. barbata* x *A. hirtula* parent, but hybrids of the latter with the species were almost completely sterile. Seed set did not appear to be closely associated with percentage of stainable pollen or differences in chromosome pairing. It is suggested that intercrossing of the artificial amphidiploids and back crossing such forms to *A. sativa* may offer a means of developing types with economic possibilities. Finally, the results are discussed with reference to interspecific relationships and to the genetics of the wild and cultivated types of grain base.

3756 Telneset, S.
Beskrivelse og klassifisering av 18 havresorter. **(Description and classification of 18 oat varieties).**
Meld. Stat. Frökontroll Ås. 1956 (1957) : 27–60.

Detailed descriptions of vegetative and panicle characters are given for 18 varieties which are recommended or show promise in Norway. Illustrations and information on parentage are included.

3757 **Seed bulletin. Oats.**
IVRO, Wageningen 1959 : Pp. 11.

This descriptive list of 23 oat varieties recommended for the Netherlands includes descriptions of the following new varieties. Addi (Eagle x Dippe Early White) yields well, has white grain fairly good in quality, shows resistance to drought and has moderately long, fairly stiff straw. Condor (Abed Minor x Express) gives very good yields on heavy soils or light fertile soils, has short, very stiff straw and forms a good companion crop. Marino (Marne x Abed Minor) also gives high yields, has short, very stiff, resilient straw and is a good companion crop; its grain and straw mature early and simultaneously.

3758 Konrads, N.
Jaunā auzu šķirne Līgo (Mutica 7281). [**The new oat variety Līgo (Mutica 7281)**].
Augsne un Raža, Rīgā 1958 : **7** : 253–58.

Ligo (Ligovo II x Stendes mazo agro [Stende Short Early]) was bred at the Stende Breeding Research Station. It outyields Soviet, Stendes mazo agro and the Latvian standard Priekuļu baltās [White Priekuļi]. It is early and resistant to *Ustilago*. The 1000-grain weight is 28–35 g. and the chaff content is low. Increased doses of fertilizers increase its yield appreciably without impairing its resistance to lodging.

3759 **Macon is new oat for Missouri area.**
Crops & Soils 1959 : **11** : No. 8 : p. 20.

Macon, from Columbia x Marion, is a new high-yielding early maturing oat. The light-coloured kernel is moderately plump and heavy with thin hulls, giving a higher percentage of groats than other leading varieties. Its height of straw and time of maturity are similar to other Missouri varieties. It is highly resistant to smut and certain races of stem rust, and has moderate resistance to crown rust. It is suitable for forage or for commercial use.

3760 Rajhathy, T. & Morrison, J. W.
**Chromosome morphology in the genus *Avena*.**
Canad. J. Bot. 1959 : **37** : 331–37.

The caryotypes of the diploid species *A. hirtula*, *A. strigosa* and *A. brevis* and a diploid form of *A. barbata* from Portugal were similar and are regarded as representing the basic set of the genus. The caryotype of these diploids is composed of a long submedian chromosome with

a small satellite on the short arm, a slightly shorter chromosome with a large satellite attached to the short arm, a subterminal with a very short arm, a median chromosome which is the largest, and three submedians. The remaining diploid species studied, *A. longiglumis*, is caryotypically distinct. The chromosome with the larger satellite is slightly longer and the ratio of the short arm: satellite is 1 : 1 instead of 2 : 1. The subterminal member of the basic set is absent. Two pairs of long median chromosomes are present, one of which is not found in the other diploids. The third median chromosome has a length between that of the two submedians, which appear to be similar to those in the other diploids. Three of the chromosomes are therefore different from those in the typical basic set. The tetraploid species *A. barbata*, *A. vaviloviana* and *A. abyssinica* possess the same caryotype. The basic set is present. The second set does not contain any chromosomes which are especially noticeable. It comprises three groups: four median or nearly median chromosomes, two long submedians and one short submedian chromosome. The colchicine-induced autotetraploid of *A. strigosa* has the basic set doubled without any visible structural changes. The hexaploids *A. sterilis*, *A. fatua*, *A. byzantina* and *A. sativa* have the same caryotype. Seven chromosomes belong to the basic set. The remaining 14 were placed in six groups: (1) a chromosome with a submedian centromere and small satellite on the short arm; (2) five long subterminals; (3) a subterminal which is the shortest chromosome in the genus; (4) two submedians, one longer than the other; (5) two long medians; and (6) three short medians. (1) resembles the chromosome with the small satellite in the basic set except that it is slightly shorter. The chromosomes in group (2) are similar to the subterminal in the basic caryotype. The typical set of the diploid is designated genome A and the set of *A. longiglumis* A′. The caryotypical observations do not support the hypothesis of an autotetraploid origin of the 4*x* species, which are assigned the genome formula AB. The hexaploid species receive the genome designation ACD. The sources of B and CD are still unknown. The evolution of hexaploids could have occurred in one step (A + CD) or two steps (A + C + D). In order to obtain information on the origin and evolution of *Avena* spp., an investigation of the Aveneae is essential. In addition, it is pointed out that the pattern of segregation in interspecific hybrids will differ from that of pentaploid wheat hybrids since in oats only one genome is common to every species.

3761 Luk'janova, M. V.
**(The forage quality of green matter of oat varieties of varied geographical origins).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 23–25. [Russian].
Many varieties have been studied at Puškin and their differences in such characters as earliness, tillering capacity, leafiness and yield and chemical composition of the green matter are described.

3762 Nilsson, B.
Metoder för laboratoriebestämning av olika havrearter. **(Methods for the laboratory determination of different oat species).**
Medd. Frökontrollanst., Stockh. 1959 : No. 34 : 83–84.
When presoaked, hulled grains are placed upon filter paper moistened with 2% phenol solution, dark staining of the grain occurs in *Avena fatua* but not in *A. sativa*, *A. byzantina*, *A. barbata* or fatuoids. Medium staining occurs in *A. barbata* and Stormogul II [Great Mogul II].

3763 Mordvinkina, A. I. & Rudjuk, I. A.
**(Varieties of overwintering oats promising for breeding).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 42–44. [Russian].
The breeding value of many varieties from the collection of the Institute of Plant Industry, with particular reference to winter hardiness, is discussed. Among the material tested at Majkop the following were found to be outstandingly winter hardy: the American varieties Wintok, Winter Turf and Fulwin and the British varieties S147, S172 and Resistance, these last three also characterized by resistance to lodging. Other winter-hardy varieties included cultivars from Serbia and Slovenia. The American varieties Letoria, Lega and Lelina are also recommended as material for breeding hardy oats. Mention is made of one Jugoslav and two Turkish oat varieties combining winter hardiness and leafiness, and of the combination of high carotene and vitamin C contents in the green matter produced by Wintok.

3764 Norden, A. J. & Frey, K. J.
**Factors associated with lodging resistance in oats.**
Agron. J. 1959 : **51** : 335–38.

Large culm diameter and large area of tissue were closely associated with high lodging resistance and there was a highly significant negative association between culm height and lodging resistance. The relationship between height and culm diameter was low, indicating that height could be modified without affecting culm diameter. Selection for shortness, an easily identifiable character, should increase lodging resistance most easily. The correlation between yield per panicle and lodging resistance was relatively low and so would be of little importance in plant breeding. No significant interaction for $cL_r$ values was obtained between stage of maturity and varieties, showing that lodging resistance could be compared at any time between anthesis and maturity, provided all strains tested were at a similar stage of development.

3765 Hooker, A. L.
**A non-parasitic leaf spot of oats.**
Plant Dis. Reptr. 1959 : **43** : 337–42.

Six oat varieties were tested at Madison, Wisc., for their reaction to nonparasitic leaf spot which appears to be caused by variable environmental conditions. The varieties Clinton and Clintafe were resistant.

3766 Simons, M. D., Sadanaga, K. & Murphy, H. C.
**Inheritance of resistance of strains of diploid and tetraplid species of oats to races of the crown rust fungus.**
Phytopathology 1959 : **49** : 257–59.

No hexaploid varieties with adequate seedling resistance to *Puccinia coronata* var. *avenae* have been found though several strains of diploid (*Avena strigosa*) and tetraploid (*A. abyssinica*) oats have a high degree of seedling resistance. The number of genes for rust resistance carried by certain strains was ascertained. In *A. strigosa* the reactions of CI7010 to races 202, 203, 216 and 264 were all conditioned by the same single major dominant gene and a minor gene was probably involved too. The very strong resistance of CI2630 to races 205, 216 and 264 was governed by single dominant genes. It was not determined if the same or different genes conditioned resistance to the different races. The resistance of CI3815 to races 205 227 and 294 is conditioned by single dominant or nearly dominant genes. In *A. abyssinica*, the resistance of CI7233 to races 202, 203, 205 and 264 and the two-type reaction of this line to race 216 were all conditioned by the same single gene, which lacked dominance. The resistance of CI7232 to race 264 is conditioned by a single, almost completely dominant gene; there was no evidence that minor genes were involved. The genes for resistance carried by these diploid and tetraploid strains were not allelic.

3767 Zillinsky, F. J., Sadanaga, K., Simons, M. D. & Murphy, H. C.
**Rust-resistant tetraploid derivatives from crosses between *Avena abyssinica* and *A. strigosa*.**
Agron. J. 1959 : **51** : 343–45.

A series of tetraploid lines, mainly derived from crosses between *A. abyssinica* ($n = 14$) and *A. strigosa*, have been tested, together with their parents, for reaction to stem-rust races 7, 7A and 8 and crown-rust races 203 and 264. All lines were resistant to the stem-rust races but a further experiment showed that one tetraploid line, Abd. 101, differed from its parents in giving an X reaction to stem-rust race 6. The reaction of the tetraploid lines to the crown-rust races was variable; some lines were resistant, some susceptible and some segregated for reaction. Resistance was presumably derived from the resistant parent *A. strigosa*.

3768 **Develop new strains of Iowa oat varieties.**
Iowa Fm. Sci. 1959 : **13** : p. 246.

New strains of Clintland and Bonham with complete resistance to all races of stem rust have been developed by back crossing.

## RYE

3769 Bremer, G. & Bremer-Reinders, D. E.
Fertiliteit en steriliteit bij tetraploide rogge. (**Fertility and sterility in tetraploid rye**).
Genen en Phaenen 1958 : **3** : 77–81.

Seed set in tetraploids studied at Wageningen, Netherlands, was about 60% in the $C_1$ generation compared with 80–85% for diploids, but by selecting and crossing the best tetraploid plants the set was raised to an average of 78·4%, several plants having 85% or more. Improved seed set was in general accompanied by greater regularity of meiosis. In a tetraploid plant bearing some normal and some highly sterile ears with just a few shrivelled grains, the good ears yielded normal tetraploid progeny while the bad ears gave some offspring with 28 chromosomes and some with 29. Among plants in which all the ears were of the highly

sterile type, some were triploid, giving diploid and tetraploid offspring, while others produced entirely diploid progeny, thought to arise through parthenogenetic development of the egg cell.

3770 Hagberg, A., & Ellerström, S.
**The competition between diploid, tetraploid and aneuploid rye. Theoretical and practical aspects.**
Hereditas, Lund 1959 : **45** : 369–416.

Investigations carried out by the Swedish Seed Association on tetraploid rye during the last ten years are discussed. The average frequency of aneuploids in nine different seed lots of the tetraploid Dubbelstål [Double Steel] was found to be 14·7%, the values for different lots varying between 6·8 and 20·4%. Sieving off the smaller grain decreases the frequency of hypoploids; if a small-grain fraction of 20% is sifted from the lot, the hypoploid frequency is decreased to about 4·5%. It is not advisable to remove a small-grain portion equivalent to more than 20–30% of the seed lot. Removing the small-grain fraction does not remove the hypertetraploids. Also low fertility is to some extent correlated with large grain size and the use of only large-grained seed may result in decrease in fertility in combination with an increase of aneuploids. The relation between fertility and seed size is not represented by a straight line, many weak plants having both low fertility and small seeds. It has also been found that the seed set of tetraploid rye is reduced when exposed to pollen from diploid rye. This is because the pollen tube of a haploid pollen grain grows faster than that of a diploid grain in a tetraploid style. Consequently triploid embryos are formed and these usually die at an early age. Similarly the seed set of diploids is reduced when exposed to the pollen of tetraploids. A small field of tetraploid rye completely surrounded by diploid rye suffered a reduction in yield of 30%. A distance of 100 m. between a diploid and tetraploid field was sufficient to avoid a decrease in yield resulting from intercrossing. However the prevailing winds during the flowering period also affect the amount of intercrossing taking place; when a field of tetraploid rye is placed leewards of a field of diploid rye, the distance between the fields should be more than 100 m.

In another series of experiments, diploid rye was mixed with tetraploid in frequencies ranging from $\frac{1}{2}$ to 50% of the total population. When the diploid frequency was between 32 and 40%, the two levels of ploidy maintained their original frequencies in the progeny. When the frequency of the diploids was below about 32%, the diploids tended to decrease. If the frequency of diploids is above this critical value, the population gradually becomes completely diploid. The critical frequency of diploids seemed to vary from year to year. The seed yield of a mixed population is not reduced in relation to that of a pure tetraploid population until the frequency of diploids is higher than 4%, the decrease in seed setting being compensated by a corresponding increase in 1000-grain weight.

In discussing problems of breeding autopolyploids, it is pointed out that autopolyploids should be considered as new distinct types separated from the corresponding diploids. Polyploids often differ from the diploids in their requirements for optimum growth; it is therefore advisable that breeders in different parts of the world should exchange polyploid material so that testing may be carried out under widely varying conditions. It is also considered important to bring as much genetic variation as possible into one tetraploid population in order to make possible new complex gene combinations. The self-incompatability system in rye seems to function best in populations with large genetic variation; this should be taken into consideration in a breeding programme for tetraploids. Selection for a regular distribution of chromosomes at meiosis in order to improve seed fertility has had very little effect in rye. Also an increase in fertility is correlated with a decrease in grain size. Hence in order to improve yield "it is necessary to select types which have a higher assimilation capacity and a more 'economical' distribution and use of the assimilates giving a higher carbohydrate production per unit area of field". Such studies are now under way.

3771 Walther, F.
Fertilitätsuntersuchungen beim Roggen.
**(Investigations on fertility in rye).**
Z. Pflanzenz. 1959 : **41** : 1–32.

Comparisons were made between diploid and tetraploid lines of Petkus normal rye at the Plant Breeding Institute of the University of Halle-Wittenberg. The tetraploids showed 5% reduction in flower number per ear and 7% reduction in fertility as compared with the diploid rye. The 1000-grain weight of the tetraploids was now 25% higher than that of the diploids whereas in investigations conducted six years ago the increase had been 50% [cf. XXV, 261].

Meiotic aberrations were noticed leading to the production of hypodiploid and hyperdiploid gametes; consequently aneuploid embryos were produced with $2n = 26$–30. Those having markedly abnormal chromosome numbers aborted. The aneuploids which comprised 18% of the tetraploid population were responsible for the reduced fertility. In the past six years the frequency of chromosome aberrations had decreased and fertility had increased. Heterogeneity of the chromosomes and physiological disturbances appeared to be responsible for the meiotic aberrations; alteration in the supply of nutrients affected the aberration frequency. Also in both $2n$ and $4n$ plants, the frequency of sterile flowers was lower in the central region of the ear and increased towards the tip and the base. The anthers in the central region ripened before those in the other parts of the ear. Measures for improving tetraploid rye are discussed.

3772 Stajkov, G.
**(The effect of curtailed day upon the branching of ears in rye).**
Selskostopan. Misăl 1958 : **3** : 463–65. [Bulgarian].

Experiments at Plovdiv with a local population which occasionally produces plants with branched ears suggested that the tendency to develop such ears is heritable. More plants with branched ears occurred among the progeny grown under 10 hr. days for periods of 10–30 days on soil given ample fertilizers.

3773 Antropova, V. F. & Večeslova, E. M.
**(Rye varieties resistant to lodging).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 45–48. [Russian].

A number of varieties and two wild species, *Secale kuprijanovii* and *S. ancestrale*, have been selected for resistance from the collection of the Institute of Plant Industry at Puškin, and anatomical and morphological characteristics which distinguish these from ryes susceptible to lodging are described. Among the Soviet varieties that did not lodge were some local varieties from western Ukraine, Stende 2 from Latvia and Kabarda, the last a selection from the Swedish variety Stålråg [Steel rye]. Resistant varieties from other countries include 3 varieties originating from Austria, 2 from the German Democratic Republic and one each from Czechoslovakia, France, Hungary, Poland and Sweden. One of the German varieties, a colchicine-induced tetraploid, is regarded as particularly valuable for breeding.

3774 Morey, D. D.
**Reaction of rye varieties to leaf rust.**
Plant Dis. Reptr. 1959 : **43** : 578–79.

Of a large number of foreign rye varieties tested for reaction to *Puccinia recondita* at Tifton, Georgia, only six showed any degree of resistance. Of these selection C58/85WR174 from South Africa showed 40% resistance. Among North American varieties, Gator, and one or two lines selected from Gator, showed a high degree of resistance. Hazel, in particular, obtained from Gator by recurrent selection for larger seed size, retained the same resistance as its parent.

## MAIZE

3775 Brandolini, A.
I metodi di miglioramento genetico del mais. **(The methods of genetic improvement of maize).**
Agricoltura, Roma 1959 : **8** : 75–80.

Mass selection, intervarietal crossing, ear to-row selection and the production of hybrids are described.

3776 Priadcencu, A.
Ameliorarea porumbului în R.P.R. **(Maize improvement in the Rumanian People's Republic).**
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 1 : 61–93.

The topics covered in this review comprise: the history of maize breeding in Rumania, breeding technique, interline and intervarietal hybrids, maize-growing zones, and descriptions of regionally approved varieties.

3777 Stanev, P. & Vălčinkov, V.
**(Research on breeding and improving maize in Rumania).**
Selskostopan. Misăl 1958 : **3** : 390–92. [Bulgarian].

The techniques employed in Rumania for the production of maize inbreds and intervarietal hybrids and for the selection of improved varieties from local populations and some of the results obtained are described.

3778 Schwartz, D.
**Genetic studies on enzymes in maize endosperm.**
Science 1959 : **129** : p. 1287. (Abst.).

Information is given on the technique of starch-gel electrophoresis being employed in a study of the enzymes involved in starch synthesis and degradation in various endosperm mutants.

3779 Brink, R. A.
**Paramutation at the *R* locus in maize plants trisomic for chromosome 10.**
Proc. nat. Acad. Sci. USA 1959 : **45** : 819–27.

"A comparison was made of the aleurone phenotypes of the $R^{r}r^{g}r^{g}$ kernels resulting from the following three matings in maize: (1) $r^{g}r^{g}$ ♀ x $R^{r}r^{g}$ ♂, (2) $R^{g}r^{g}$ ♀ $R^{r}$ $R^{st}$ (disomic) and (3) $r^{g}r^{g}$ ♀ x $R^{r}/R^{st}/r^{g}$ ♂ (trisomic). The male parents were moderately inbred sibs, and the $r^{g}$ $r^{g}$ final parent was a highly uniform inbred strain. The object of the experiment was to test the hypothesis that paramutation of $R^{r}$ to a weakly pigmenting form, conveniently designated $R'$, which was known from previous observations to occur in 100% of the cases in $R^{r}$ $R^{st}$ plants, takes place at the zygotene stage of meiosis, when the $R^{r}$ and $R^{st}$ alleles are synapsed. The $r^{g}$ allele present in the $R^{r}$ $r^{g}$ and $R^{r}/R^{st}/r^{g}$ individuals had earlier been shown to be nonparamutagenic. Assuming 2 by 2 pairing at zygotene at any given chromosome level, only the $R^{r}$ male gametes that carry ex-conjugants from $R^{r}$–$R^{st}$ zygotene pairings should be paramutant, and the rest should be normal, if the hypothesis in question is valid. Not more than 50%, and perhaps as few as 33%, of the $R^{r}$ gametes formed by the $R^{r}/R^{st}/r^{g}$ trisomic plants should be paramutant on this basis. Aside from a few seeds on both groups of testcross ears that could have resulted from pollen contamination, it was found that the $R^{r}$ $r^{g}$ $r^{g}$ ($R'$ $r^{g}$ $r^{g}$) kernels resulting from the application to $r^{g}$ $r^{g}$ individuals of pollen from the trisomic $R^{r}/R^{st}/r^{g}$ plants, as well as from the disomic $R^{r}$ $R^{st}$ controls, were of the paramutant phenotype throughout. The $r^{g}$ $r^{g}$ ♀ x $R^{r}$ $r^{g}$ ♂ mating yielded the expected 50% of standard $R^{r}$ $r^{g}$ $r^{g}$ seeds. The results of the experiment, therefore, negate the hypothesis that $R^{r}$ is changed to the paramutant form, $R'$, in $R^{r}$ $R^{st}$ plants, when the $R^{r}$ and $R^{st}$ alleles are conjugated at zygotene." [cf. XXVIII, 1614, XXVII, 4004 and XXIX, 3368].

3780 Bunting, E. S., & Willey, L. A.
**Studies on maize for grain production. I. Variety trials.**
J. nat. Inst. agric. Bot. 1958 : **8** : 364–77.

The results of 50 trials of 55 varieties and hybrids at several centres in southern England during the five-year period 1953–57 are given. Data on yields of dry grain were obtained from 28 trials. Considering both earliness and productivity, the Dutch flint x Dutch dent hybrids Prior and Matador and the experimental hybrids CB45 and CB47 were the most suitable. Detailed information is provided on 35 of the varieties with respect to grain production, data of pollen shedding, moisture content of grain, plant and ear heights and lodging.

3781 Aus der Arbeit der Sektion Landwirtschaftliches Versuchs- und Untersuchungswesen. 4. Sektionssitzung 1958. (**From the work of the Section of Agricultural Experimentation and Investigation. IVth Session of the Section, 1958**).
Z. landw. Vers.- UntersuchWes. 1958 : **4** : 382–84.

Müller from Bernburg spoke on Entwicklung und Anwendung neuer Zuchtmethoden beim Mais [The development and application of new breeding methods in maize]. Tests of the combining ability of 105 foreign varieties with Bernburger Fettmais [Bernburg Fat maize] showed that both flint and dent maize can be good parents. Crossing varieties of different convarieties did not give better results than crossing varieties within a convariety. The results obtained hitherto indicate that the breeding of hybrid maize in Germany will be rewarding.

3782 Fehér, K.
A korai hibridkukorica nemesítése. (**Breeding of early hybrid maize**).
Agrártudomány 1959 : **11** : No. 2 : 20–22.

Data on the performance of Hungarian hybrids in Hungary and other countries are presented. Mv. 40 ripens earlier than Mv.5, Ov.1 or Ov.5 in Hungary and together with Mv.42 has also done well in East Germany. In Poland the Martonvásár hybrids have surpassed Wisconsin 255.

3783 Fenaroli, L.
**Technical problems of corn growing in Italy.**
Euphytica, Wageningen 1958 : **7** : 228–36.

This is a translation of an Italian article already summarized [XXVIII, 4144].

3784 Malucelli, P.
Osservazioni sulla coltivazione comparativa di nuovi tipi commerciali di mais ibrido. (**Observations on the comparative cultivation of new commercial types of hybrid maize**).
Ann. Sper. agr. 1959 : **13** : 119–27.

Observations made in 1956 on 11 hybrids and three local varieties of the Italian province of Forlì are reported. The best yield, corresponding to 65·12 c. of grain per ha., was given by the hybrid Pioneer 325, which was followed by the

cultivar Caragua, and the hybrids Wisconsin 355 and Pioneer 317 with 60–63, 59·39 and 58·37 c. respectively. The lowest was Nostrano dell'Isola with 31·97 c. but this variety had the highest ratio of protein to other digestible constituents.

3785 Fenaroli, L.
In un mondo in evoluzione anche il paesaggio maidicolo italiano si trasforma. (**In a world in evolution even the Italian maize landscape is being transformed**).
Agricoltura, Roma 1959 : **8** : 61–63.

Though dent hybrids of the American type have been replacing the local Italian flint maize on account of their higher yields, they in turn are being supplanted by dent x flint hybrids produced in Italy, such as Insubria 295, 295A and 521 and IAB 300.

3786 Musijko, A. S.
(**The methods and results of research on breeding and seed production of maize**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 7 : 79–85. [Russian].

Maize breeding, including the production of inbreds, at Odessa is discussed. Observations on the inbred lines 44, 43, 40 and 38 showed that their selfed progenies sometimes differed in respect of growth period, plant height, mode of attachment of the ears, mean ear weight and 1000-grain weight. Inbreds have been selected with a protein content of 14·9 upwards and seven top crosses which are more productive and earlier than the double cross VIR42 [Institute of Plant Industry 42] have been obtained. Bezenčuk x line 44 is the most productive of these and Spasovo x line 44 has the shortest growth period. In addition, new forage types have been obtained by crossing early varieties with late; these are twice as productive as the early parent and intermediate in growth period. Odessa 10, a forage type previously bred at Odessa, has been subjected to further tests in many districts, including the province of Moscow, and proved more productive of dry matter than the standard varieties and hybrids in most localities.

3787 Musijko, A. S., & Ključko, P.
(**The characteristics of maize hybrids obtained by crossing early with late varieties**).
Dokl. Vsesojuzn. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 6 : 3–5. [Russian].

Hybrids between (1) late dents such as Odessa 10 and (2) Spasovo or other early flints from Odessa are described. All the hybrids were intermediate in growth period and plant height, but there was some difference between direct and reciprocal hybrids, earliness and plant height tending to be matroclinous. All hybrids were more productive of grain than their parents but they were inferior to the late parents in silage yield. Some hybrids, in particular Bezenčuk 41 x Odessa 10 and Voronež 76 x Odessa 10, have proved their worth as forage varieties in recent trials at Moscow.

3788 Telkiev, G. & Tomov, N.
(**Testing our first double-cross hybrids of maize**).
Selskostopan. Misăl 1958 : **3** : 271–76. [Bulgarian].

The production of maize inbreds, double crosses and top crosses at Poljanovgrad is described. A large collection of inbreds characterized by good combining ability has been amassed. A table lists some double crosses which outyield the standard intervarietal hybrid A26 x Čirpan 96. Most of the inbreds are flints derived from Čirpan 87 or Čirpan 96. The origin of the dent lines is not specified. Both flint and dent inbreds comprise plants of two distinct types, some being sturdy and ripening early, others having taller stems and maturing later. The early flint inbreds have dark leaves and bear two ears, the latter characteristic being transmitted to the offspring.

3789 Kalinina, Z. G.
(**Intervarietal maize hybrids in Siberia**).
Agrobiologija (Agrobiology) 1958 : No. 5 : 80–85. [Russian].

The best hybrids bred at Novosibirsk were those from crossing early Siberian populations or varieties with midseason cultivars from European Russia and from crossing midseason varieties of different geographical origins. These yielded more grain and forage than both parents and exceeded them in earliness. Hybrids between early Siberian forms or midseason varieties from Russia with late types such as Minnesota 13 and Sterling were the most productive of forage. Hybrids between early and midseason forms were intermediate in grain and forage yields between the above mentioned hybrids.

3790 Brandolini, A.
Il mais in Somalia; prospettive di miglioramento. (**Maize in Somaliland; prospects of improving it**).
Maydica, Bergamo 1959 : **4** : 46–54.

Preliminary tests have shown two hybrids,

Embro 101 and Texas 30, to be capable of giving yields greatly exceeding those of the varieties grown up to now, all of which are the products of mass selection. However, both these have yellow grain and the white-grained forms are the more popular. Therefore the local populations are being selfed and a number of $S_3$ lines are being tested for combining ability; the first double crosses are expected to be released in 1961 and the production of synthetic hybrids suitable for small cultivators is also envisaged.

3791 Hoen, K.
**Performance of corn hybrids with various ratios of flint-dent germplasm in different environments.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7496 : p. 1505. (Abst.).

Further details are given on investigations which have already been briefly reported [cf. XXVIII, 1321].

3792 **South Dakota releases new early corn hybrid.**
Crops & Soils 1959 : **11** : No. 8 : p. 20.

South Dakota 210, from (SD5R x B8) x (SD26 x A509), yields as much or more than SD220 and SD250, and matures early. It produces approximately one-half yellow and one-half reddish yellow ears. Its stalks are uniformly slender with an average height of six to seven feet and the ears are approximately three feet from the ground. Lodging is negligible.

3793 Krstić, N. V.
Prinosi i osobine nekih medjuliniskih hibrida kukuruza. (**Yields and other characteristics of some interline maize hybrids**).
Arh. poljopr. Nauk. 1958 : **11** : No. 32 : 92–100.

The American maize inbreds Wisconsin 641AA, Iowa 4316, Nebraska 301 and Wisconsin 692 outyielded the standard variety Rumski Zuban [Ruma Dent] by an appreciable margin in recent trials at Kragujevac. All the above inbreds ripened at about the same time as the standard and other Jugoslav cultivars. US13 and Ohio C92 were also highly productive in most years, but they are thought to be less valuable on account of their long growth periods.

3794 Leng, E. R. & Ross, G. L.
**Performance of commercial corn hybrids in Illinois, 1958.**
Bull. Ill. agric. Exp. Sta. 1958 : No. 635 : Pp. 46.

Tabulated data on yield, moisture content of the grain, percentage of erect plants and stand are given for 479 hybrids grown at ten test localities during 1958. Five, three and two year summaries, indicating the highest yielding hybrids, are given for some of the localities.

3795 Jugenheimer, R. W. & Williams, K. E.
**Performance of experimental corn hybrids in Illinois, 1958.**
Bull. Ill. agric. Exp. Sta. 1958 : No. 636 : Pp. 46.

Data from trials of inbreds and sister-line, single, double and three-way crosses on yield, moisture content of the grain, shelling percentage, number of erect plants, stand, ear height, incidence of dropped ears and smut infection at four representative localities are recorded. Among the hybrids tested were high-oil and high-protein forms and sweet-stalked types for silage.

3796 Stringfield, G. H.
**Maize inbred lines of Ohio.**
Res. Bull. Ohio agric. Exp. Sta. 1959 : No. 831 : Pp. 67.

Detailed descriptions of inbreds used in the production of commercial hybrids in Ohio are provided.

3797 van Schaik, T. *et al.*
**Performance of South African maize variety crosses.**
S. Afr. J. agric. Sci. 1958 : **1** : 423–33.

Fifteen varieties representative of the different types commonly grown in South Africa and all possible $F_1$ crosses between them were compared in replicated yield trials in five localities in South Africa. Heterosis in each cross was evaluated in terms of the percentage of the parental mean. Among the various crosses and in the different trials, this heterosis value ranged from 65 to 196, with a mean of 116. For each trial, data are given on the mean yield of each variety ($V$), the mean yield of all the crosses in which a particular variety was involved ($X$) and "the ratio of $X$ to the mean of ($a$) that variety and ($b$) the mean of all the other varieties with which it was crossed, $X/M$." A highly significant correlation coefficient of $-0{\cdot}36$ was obtained between $V$ and $X/M$, indicating a slight but definite trend for varieties giving lower yields to show more hybrid vigour when crossed than the better varieties. A high positive correlation was found between $V$ and $X$. No significant correlation was detected between $X$ and $X/M$. The negative correlation between $V$ and $X/M$ is interpreted in terms of genotype-environment interaction; it is suggested that "a specific environment may to a

larger extent allow additional gene action for yield to express itself at a low genetic level of production than at a high level". The pronounced differences in heterosis values for the same cross in different localities and the differences between mean heterosis values for localities when the data for all the varieties were combined may also be ascribable to genotype-environment interaction. The application of the results to breeding in South Africa is discussed. Choice of parental varieties should be primarily based on specific combining ability in a particular locality. Varieties showing high general combining ability and specific combinations giving high heterosis values according to locality are indicated.

3798 Mitkov, T., Kădrev, T. & Berova, S.
**(Studying the temperature of seed germination of several maize varieties and hybrids).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 203–14. [Bulgarian].

The shoots of hybrids, especially of A26 x Žălta Dobrudžanska [Yellow Dobrudža] and the reciprocal hybrid, emerged more uniformly and earlier than those of varieties at various temperatures.

3799 Tsotsis, B.
**The use of thermal and photothermal units for describing flowering and maturation in maize.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–5379 : 1156–57. (Abst.).

A report is given of the results of an investigation into the possibility of devising a system for designating the maturity ratings of recommended hybrids on the basis of measurement of thermal and photothermal units from planting to flowering and ripening. It was concluded that such a system would constitute an improvement over the customary use of calendar days.

3800 István, K.
A kukorica nemesítése, a hibridkukorica vetőmag szaporítása. **(Maize breeding and the multiplication of hybrid maize seed).**
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 51–55.

In tests of Martonvásár hybrids, Mv5 outyielded the best American hybrid by 19% in Austria while in Rumania Mv1 was the best of all varieties. The recent hybrid Mv39 compares well with the two others. Male sterility has been introduced into C5, Iregi 12 hetes [Ireg 12 Weeks] and Bádeni Korai [Báden Early] and work on cold resistance is in progress.

3801 Brandolini, A.
L'utilizzazione della sterilità ereditaria del polline nella produzione commerciale delle sementi ibride di mais. III. **(The use of herditary pollen sterility in the commercial production of hybrid maize seed. III).**
Maydica, Bergamo 1959 : **4** : 55–61.

In the third part of this article [cf. 2589], data are given on the characteristics of some hybrids produced from restorers isolated from Italian maize populations, in crosses with the American male-steriles $WF9^T$ and $WR3^T$.
A modified method of transferring restorer genes to a line after it has been constituted is being used at the maize breeding station at Bergamo and is described. It consists in (1) crossing the line to be converted on to a cross between a sterile line and a restorer line; (2) back crossing the $F_1$ on to the line to be converted; and (3) continued back crossing of the line on to the fertile segregates. The lines produced in this way are possessed of sterilizing cytoplasm combined with a restoring system; they can therefore be reproduced by selfing, by open pollination under isolation or by intercrossing.

3802 Sokolov, B. P.
**(An important principle of maize breeding and seed production).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 7 : 63–65. [Russian].

This extract from an address delivered to the Lenin Agricultural Academy in April 1958 deals with the production of heterotic hybrids for grain or forage in the USSR. Mention is made of the development of male-sterile and fertility-restoring lines at Krasnodar, Dnepropetrovsk, Cernovcy, Kišenev and in the Kuban'. The growing of maize for forage in the north is also discussed, some varieties and hybrids with high yields of green matter being named and the production and testing of top crosses and intervarietal hybrids is recommended. The ♀ component should be provided by early cultivars and the pollen parent by single crosses or the varieties Sterling, Minnesota 13 or Ivory King.

3803 Tedoradze, S. G.
**(The pollen viability of hybrids).**
Kukuruza (Maize) 1958 : No. 7 : 20–21. [Russian].

The pollen of the maize hybrid Kartuli-Krugi

x Klaradža was found to be more active and remained viable longer than the pollen of Kartuli-Krugi or Klaradža in studies at the Georgian Breeding Research Station.

3804 Landi, R.
Il Mielmais, ibrido di granturco da foraggio. (**Mielmais, a hybrid of fodder maize**).
Ital. agric. 1959 : **96** : 409–18.

An American hybrid, HS50, has been introduced commercially in Italy under the name Mielmas [Honey maize] on account of the high sugar content of the stem. Tabular data are presented which show that in tests carried out in 1958 in different parts of Italy HS50 exceeded the local variety Caragua in yield of green matter and its Brix values varied from 12 to 14·1 compared with 7·1 to 10·7 in Caragua and lower still in open-pedigree hybrids Wisconsin 355, 461 and 464; the stems of HS50 also have a lower fibre content and are more palatable to livestock. Other HS hybrids tested were not quite so good as HS50.

3805 Zucchini, I.
Un nuovo mais da foraggio. Il Mielmais cinquanta ad alto contenuto di zucchero. (**A new fodder maize. Mielmais 50 with a high sugar content**).
G. Agric. 1959 : **59** : p. 102.

Mielmais 50 [Honey maize 50] is described as a hybrid from the USA which, in tests over a large area in northern and central Italy, has exceeded all local varieties in yield of forage, which moreover has a higher sugar percentage than that of the local maize [cf. 3804].

3806 Robinson, H. F., Khalil, A., Comstock, R. E. & Cockerham, C. C.
**Joint interpretation of heterosis and genetic variance in two open pollinated varieties of corn and their cross.**
Genetics 1958 : **43** : 868–77.

In a further study of the two open-pollinated varieties Jarvis and Indian Chief and the cross between them, analysis of the data on yield led to the following conclusions [cf. XXV, 3044 and XXVI, 3274]. Heterosis in the intervarietal cross exceeded the mid-parental value by over 20%. The component of variance due to genetic differences between ♂ parents was greater within varieties than in the intervarietal cross. The component of variance due to genetic differences between ♀ parents mated to the same ♂ plant was also greater in the varieties than in their cross. The results are in agreement with the model assuming additive gene effects with partial to complete dominance and without epistasis or multiple alleles.

3807 Ballesteros, O. Q.
**General and specific combining ability of $S_2$ College White Flint and $S_3$ Bicol White Flint inbred lines.**
Philipp. Agric. 1958 : **42** : 231–49.

Two local varieties of maize, College White Flint and Bicol White Flint, which differed in many agronomic characters and in their reaction to insect pests and diseases, were used as a source of inbred lines. Evaluation of these lines was made by top crossing with a tester parent, Davao White Flint. Twenty-three top crosses yielded significantly more than the tester parent. The pooled analysis of variance of the $S_3$ Bicol White Flint top crosses showed insignificant interactions between top crosses and localities and among top crosses, localities and seasons, indicating that a performance test to determine general combining ability conducted at one place would suffice as a basis for either eliminating or including an inbred line in the subsequent specific combining-ability tests. The inbred lines with high general combining ability were further tested for specific combining ability using a single cross (L314 x L315) of known performance as tester. Since a highly significant interaction between locality and three way crosses was obtained in the determination of specific combining ability, it is necessary for tests to be conducted in more localities and in more seasons in order to obtain sufficient information on the yielding potentiality of the specific crosses.

3808 Rumbaugh, M. D.
**The effect of inbreeding diallel crosses of inbred lines of corn selected for high and low combining ability.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3775 : 1154–55. (Abst.).

Four $S_1$ lines with high and four $S_1$ lines with low combining ability were selected from the open-pollinated variety Krug Yellow Dent on the basis of a top-cross yield test with the parental variety. Further divergent selection was practised for four selfed generations, according to the results of test crosses of the lines in combination with the tester WF9 x M14. The $S_5$ lines were intercrossed in an 8 x 8 diallel scheme. Selfing of the hybrids was carried out until $F_5$ seed was produced. Data on grain yield per acre and plant and ear height were recorded for the parental lines and for each generation of the single-cross hybrids in replicated field trials in

1956 and 1957. The effects of inbreeding on phenotype in relation to the combining ability of the parents were studied and interpreted on the basis of analysis of variance of the regression trends, constant parent-progeny regression and graphic diallel analysis. The influence of inbreeding upon ear height in hybrids involving parents with low combining ability could be satisfactorily explained on the assumption of additive gene effects. This interpretation did not however offer a complete explanation of the genetic situation as regards (1) ear height in crosses among parents with high combining ability or (2) yield and plant height in all the crosses. An average of 1·6% of the variation in yield and 7·9% of the variation in plant height could not be attributed to the linear regression of phenotype on the extent of homozygosity. Dominance relationships were not clearly defined. Although in general the data were indicative of partial dominance, some crosses gave limited evidence of overdominance. Rank correlations of the order of dominance of the parental lines as determined by four methods of estimation were nonsignificant in 74% of the comparisons.

3809 Ting, Y. C.
**Inversions and other characteristics of teosinte chromosomes.**
Cytologia, Tokyo 1958 : **23** : 239–50.

Earlier reports in the literature have indicated that teosinte differs from maize not only with respect to certain chromatin segments, possibly from *Tripsacum*, but also in chromosome rearrangements. In order to determine the positions of such rearrangements, an analysis was made of $F_1$ hybrids between maize and three teosinte varieties, viz. Huixta from northern Guatemala and Durango and Nobogame from Mexico. The maize inbred chiefly used as parent was derived from Wilbur's flint, which is virtually knobless and imparts the character of well-spread chromosomes at pachytene in PMC preparations. The cross of Huixta showed no inversions. This variety differed from other Guatemalan teosintes previously studied in having the majority of its knobs along the chromosome, instead of situated terminally. About 12·3% of the PMCs had $2_I$ and 0·8% $4_I$ at diacinesis. These frequencies of univalents and the fact that synapsis was complete at pachytene may have been indicative of a certain amount of nonhomologous pairing. Hybrids with Durango were heterozygous for two inversions contributed by the teosinte parent, respectively situated on chromosomes 8 and 9 in a terminal or nearly terminal position and representing 59% and 56% of the short arm. At diacinesis, 0·8% of the PMCs had $2_I$; a higher number of univalents was not observed. Two knob positions in Durango are reported for the first time: one on the long arm of 8 and the other on the long arm of 9. Hybrids with Nobogame were heterozygous for three inversions contributed by the teosinte parent. Two were terminal or nearly terminal, respectively situated on the short arm of 8 and short arm of 9, and representing 62% and 59% of the arm. The third inversion, found on the long arm of 5, was paracentric, its length being equivalent to about 50% of the arm. At diacinesis, 11·8% of the PMCs had $2_{II}$ and 0·4% $4_I$. The chromosomes of Nobogame have only five knobs, comprising a prominent terminal knob on the short arm of 7, medium-sized knobs on the long arms of 2 and 4, a small knob on the short arm of 1 and a small terminal knob on the short arm of 6. Dicentric bridges and acentric fragments were seen at anaphase I and II in the two last-mentioned hybrids.

3810 Bálint, A., Kovács, A. & Jelenits, K.
Az *Euchlaena mexicana* szerepe a kukurica fehérjetartalmának növelésében és minőségének javításában. (**The utilization of *E. mexicana* in the qualitative and quantitative improvement of protein content in maize**).
Növénytermelés 1958 : **7** : 235–48.

At Gödöllő, Hungary, hybrids between *E. mexicana* and maize had a higher protein content than maize but were highly variable in vigour, degree of branching, earliness and ear characters. Back crosses to the maize varieties Bánkút and F-Korai [F Early] resulted in an improvement in habit but protein content decreased, although not to the level of the maize varieties.

3811 Kedharnath, S. & Brink, R. A.
**Transposition and the stability of modulator in maize.**
Genetics 1958 : **43** : 695–704.

Modulator (*Mp*) is a transposable component of the variegated pericarp allele $P^{vv}$ [cf. XXVII, 1725]. In order to determine whether modulator is stable during transpositions from the *P* locus, a series of independent *Mp* transpositions derived from a common $P^{vv}$ allele were studied in two highly uniform genetic backgrounds provided by the inbreds 4Co63 and W23. The effect of the transpositions in reducing the frequency of somatic mutation of $P^{vv}$ to $P^{rr}$ was compared. The eight transpositions in the

4Co63 background comprised two groups differing significantly in their effect on the somatic mutation. This is thought to indicate that transposed modulator can exist in two different states. The five transpositions studied in the W23 did not show significant differences with regard to their effect on the frequency of somatic mutation; in this genetic background modulator was stable.

3812 Coe, E. H. (Jun.)
**A regular and continuing conversion-type phenomenon at the *B* locus in maize.**
Proc. Nat. Acad. Sci. USA 1959 : **45** : 828–32.

A detailed account is given of the conversion of *B* (chromosome 2) for intense anthocyanin pigmentation of the plant by *B′* for weak pigmentation [cf. 961].

3813 **Cytoplasm can alter genetic effects.**
Agric. Res., Wash. 1959 : **7** : No. 10 : p. 5.

Cytoplasmic influence on ear height of maize was revealed when genotypes with different cytoplasms were compared. Ear height was generally lower in plants having cytoplasmic male-sterile cytoplasm, but its effect in the progenies of different crosses, indicated that a particular cytoplasm has a greater effect on some genotypes than on others. Pollen-restored plants were superior in yield to male-sterile plants [cf. XXVIII, 4188].

3814 Matzinger, D. F., Sprague, G. F. & Cockerham, C. C.
**Diallel crosses of maize in experiments repeated over locations and years.**
Agron. J. 1959 : **51** : 346–50.

Diallel crosses of ten parents randomly selected from a randomly mating variety, Low Ear, were tested to determine the relative importance of general and specific combining ability and their interactions with years and localities. There appeared to be very little variance of general combining ability but considerable variance of specific combining ability. Significant variances of interaction were obtained for general combining ability x years, general combining ability x years x localities and specific combining ability x localities, the last only at the 5% level of significance. The results obtained indicate that the estimate of general combining ability is of little value as a criterion for selection in this population; the use of specific combining ability is regarded as more valuable.

3815 Nelson, R. R.
**Genetics of *Cochliobolus heterostrophus*. IV. A mutant gene that prevents perithecial formation.**
Phytopathology 1959 : **49** : 384–86.

Crosses of wild-type conidial strains of *C. heterostrophus* yielded monoascosporic isolates which exhibit complete mating inhibition to both parental strains and to about half the wild-type isolates of the opposite compatibility group. The mating-type inhibition is controlled by a single recessive gene *i*, inherited independently of the locus for compatibility. This inhibitor gene appears to block the formation of protoperithecia. The widespread occurrence of the mutant gene in the wild-type *a* strains, and its absence in the wild-type *A* strains indicate that the establishment of the *i* locus occurred early in the evolution of the species. The presence of the *i* locus also indicates a basic genetic difference among strains of the *a* compatibility group. [Cf. 3835].

3816 Helmerick, R. H.
**Gamete sampling from a seriated sample of $S_1$ lines of corn.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–5908 : p. 1504. (Abst.).

The aim of this investigation was the evaluation of gametes originating from a sample of $S_1$ lines from a topcrossed series, coupled with an attempt to improve Nebraska 503 [(Wf9 x N6) x (Oh7 x 187–2)] by using Stadler's gamete sampling scheme. The frequency distribution of 148 $S_1$ Stiff Stalk Synthetic plants evaluated in top-crosses with a "broad gene base" tester was partitioned according to intervals of one standard deviation on either side of the mean. Four $S_1$ lines from each of the four resulting intervals were subsequently selected in order to study the gametes corresponding to each interval in the range. The two élite inbreds, Oh7 and 187–2, used as the gamete samplers, were each crossed with two $S_1$ lines within each interval. Twelve gametes from each of the resulting $F_1$ families were evaluated in test crosses with Wf9 x N6 in replicated field trials in 1955 and 1956. About 48% of the 192 gametes studied were superior to those from the élite inbreds in the test crosses. The greater percentage of superior gametes originated from the upper half of the frequency distribution of the original Stiff Stalk Synthetic plants. Gametes giving the better performance were selected from each inbred series regardless of the interval with which they were associated

in their origin. Thirty-five single-cross combinations were produced from the two gamete/line series. The ♂ single-cross parent, Oh7 x 187–2, of Nebraska 503 was replaced by these (Oh7/gamete x 187–2/gamete) single crosses in the production of 35 double crosses. The predicted values for the double crosses from the 1957 test-cross series indicated that 31 of the 35 would exceed the control hybrid in yield. The single crosses from the gamete series were however no better than the control single cross, Oh7 x 187–2, in test crosses with Wf9 x N6. Twenty-two of the double crosses involving the gamete series were equal to the control hybrid at the 5% level of probability. It was concluded, however, that Stadler's scheme offers a promising means of improving yielding ability and other agronomic characters of élite inbreds. Further refinement in testing procedures appears to be necessary if maximum efficiency is to be attained in applying this method.

3817 Musiiko [Musijko], A. S. & Kliuciko [Ključko], P. F.
Noul soi de porumb Odesa 10. (**The new maize variety Odessa 10**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 71–76.
[Cf. XXVI, 1263].

3818 Solov'ev, B. F.
(**Top-grade seed for new districts**).
Kukuruza (Maize) 1958 : No. 6 : 28–30. [Russian].
This article discusses what maize varieties and hybrids should be grown in the different geographical regions of the USSR, especially in the eastern and northern districts, where maize is grown mainly for forage. A number of intervarietal hybrids, top crosses and double crosses which have been made standards in 1958 are listed.

3819 Green, J. M.
**Climatic races in Guatemalan maize.**
Iowa St. Coll. J. Sci. 1958 : **33** : 185–98.
Samples of field maize were collected in Guatemala at altitudes varying from 250 to 8300 ft.; these samples were then grown at altitudes of 75, 5000 and 8133 ft. The yield data clearly indicated the existence of climatic races adapted to different altitudes. For example, collections from the highest regions produced very little grain when grown at a low altitude but gave the highest yields at 8133 ft. The races were not so easily distinguished by their maturity period and plant height. Only two of the 103 collections studied differed in their performance from others of the same altitude range, thus indicating that there had been very little transfer of types from one altitude to another. Within the climatic races were found types diverging in their morphological characters and pigmentation but within types there was a high degree of uniformity.

3820 Bianchi, A.
I cromosomi e i knobs del mais.
(**Chromosomes and knobs of maize**).
Maydica, Bergamo 1959 : **4** : 35–45.
The published information on chromosome knobs is passed in review. In over 100 Italian maize varieties studied no negative correlation has been demonstrated between number of knobs and number of B chromosomes, both being relatively infrequent. The higher frequency of knobs in the maize grown in the USA may, it is suggested, be a result of selection for heterosis; if the knobs are derived from *Tripsacum*, a greater number of them would be associated with greater heterozygosity.

3821 Lima-de-Faria, A.
**Compound structure of the kinetochore in maize.**
J. Hered. 1958 : **49** : 299–302.
Recent work, which is briefly reviewed, has shown the centromere to be composed of as many as three chromomeres and four fibrils, thus indicating that the structure is sufficiently complex to permit rearrangements leading to the formation of centromeres with different genetic constitutions.

3822 Fabergé, A. C.
**Relation between chromatid-type and chromosome-type breakage-fusion-bridge cycles in maize endosperm.**
Genetics 1958 : **43** : 737–49.
"An experiment is described whose purpose was to ascertain whether, in maize endosperm, separately broken chromosomes will fuse to generate a composite chromosome-type breakage-fusion-bridge cycle. Markers in the short arm of chromosome 9 were used, and breaks were induced by the *Ds–Ac* system. The markers and positions of breaks were such that if reunion between two broken chromosomes occurred, the event would be phenotypically recognizable on the endosperm mosaic. It was found that each broken chromosome end undergoes a breakage-fusion-bridge cycle (presumably initially of chromatid type) on its own and that fusion of different broken chromosome ends to give a composite chromosome-type breakage-fusion-bridge cycle does not occur in endosperm at a detectable frequency. In this respect,

endosperm differs from the sporophyte but is similar to the gametophyte."

[Author's summary].

3823 Kreizinger, J. D.
**Diepoxybutane as a chemical mutagen in maize.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–5880 : 1176–77. (Abst.)

Two methods of treating pollen with diepoxybutane were used. (1) Newly shedding tassels were taken from homozygous multiple dominant stocks and the cut ends placed in a 0·2% solution for 18 hr. (2) A hole was bored in the stalk about 4 in. below the lowest tassel branch. A vial containing 4·5 c.c. of a 0·2% solution was attached to the stalk and a piece of woven-glass wick used to introduce the chemical into the plant. Using homozygous multiple recessive stocks, crosses were effected with treated and control tassels as the sources of pollen. Losses of dominant markers in the endosperm of the resulting kernels were used as a means of determining the mutagenic effect. The multiple recessive stocks had the chromosome-9 markers *c sh wx* or *C sh bz wx*. Since the order of marked loci distal to the centromere is known to be *Wx Bz Sh* and *I* (or *C*), the position and number of breaks within marked regions of the chromosome arm could be determined from the endosperm phenotype. Breakage-fusion-bridge cycles, as well as interstitial deletions and end losses were frequently induced. The main results and conclusions were as follows. (1) The proportion of $F_1$ kernels showing single or multiple gene losses was about 12%. The frequency of mutation was not influenced by year of treatment or stock. (2) No evidence was obtained of differential sensitivity of the pollen to the chemical on any of the five days preceding pollen shedding. (3) The two multiple dominant stocks differed significantly in the number of breaks distal to *I*, as well as in the number between *Wx* and the centromere. This result may be due to differential sensitivity of some chromosomal regions to breakage or to sampling error. (4) The distances between marked loci in the short arm of chromosome 9, as determined by the relative frequency of breaks occurring between these loci, corresponded closely with the distances estimated on the basis of pachytene observations. Breakage due to diepoxybutane was therefore concluded to be at random. (5) The number of kernels with sectors of mutant tissue was about twice the number having exclusively mutant tissue. It is postulated that sectoring may be due to (*a*) interference by the chemical with chromosome duplication and subsequent breakage of the affected chromatid or (*b*) changes in the chromosomal matrix which tend to favour restitution of at least one chromatid after division of the broken chromosome. (6) No evidence was forthcoming that diepoxybutane markedly increases the frequency of gene mutation, although the loss of single loci may have included some gene mutations. Furthermore, the pollen treatment had little or no mutagenic effect on the $F_1$ plant generation.

3824 Crane, P. L., Miles, S. R. & Newman, J. E.
**Factors associated with varietal differences in rate of field drying in corn.**
Agron. J. 1959 : **51** : 318–20.

As different strains of maize differ in drying rate of the ear, several factors, including moisture flow from plant to ear, husk length and width, number of husks per ear, number of split husks, shank length, ear length and circumference, osmotic diffusion pressure of the kernel and pericarp permeability, were examined in an attempt to learn if they were associated with the different drying rates. Neither husk and shank characteristics nor shape and size of ear were found to be major factors associated with differing rates of drying among strains of corn. There was a small but consistent difference in osmotic diffusion pressure of kernels and a more pronounced difference in pericarp permeability between a fast and a slow drying hybrid. Lower osmotic diffusion pressure of the kernels and the more permeable pericarp were associated with more rapid drying.

3825 Cauderon, A.
Les maïs-hybrides en France. Étude de la précocité. (**Maize hybrids in France. A study of earliness**).
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 273–89.

In France, lack of warmth is the most important factor limiting the cultivation of maize and earliness is a very important varietal character. The most productive varieties are those which make full use of the period favourable to growth, i.e. they ripen just before the climate becomes unfavourable. Considering the effect that temperature has on the development of maize, it is thought that the number of days in the growing period is not a good measure of earliness; a better one is the sum of the daily temperatures above + 6° C. from sowing to

maturity. The grain is considered to be mature when the moisture content is 35%. Hybrids cultivated in France have been classified according to this system. The geographical distribution of maizes of differing earliness in France is discussed in relation to average temperatures during the growing period.

3826 Berzsenyi-Janosits, L.
Bövebben terem-e késői kukorica? Adatok a hibrid kukoricák értékeléséhez. (**Does late maize give higher yields? A contribution to the evaluation of maize hybrids**).
Növénytermelés 1958 : **7** : 265–68.
In comparative trials of American hybrids at Magyaróvár, Hungary, a positive correlation between kernel yield and duration of vegetative period was found among early hybrids but not among late.

3827 Bálint, A.
Adatok a kukorica szelektív termékenyüléséhez. (**Data on the selective pollination of maize**).
Növénytermelés 1958 : **7** : 321–24.
The white variety Mindszentpusztai fehér [Mindszentpuszta White], when pollinated with an equal mixture of its own pollen and pollen from the yellow variety F-Korai [F-Early], yielded a larger number of white than yellow grains, indicating that the first variety has a marked preference for its own pollen. This preference was even more pronounced when inbred strains of Mindszentpusztai fehér were used as female parents. A 2 : 1 ratio of foreign to own pollen gave a ratio of 63·4 : 36·6 for yellow to white grains.

3828 Simonguljan, N. G.
(**Additional facts on the flowering and fertilization of maize**).
Agrobiologija (Agrobiology) 1958 : No. 4 : 49–52. [Russian].
Controlled experiments with varieties having white or yellow grain at Taškent are described, the following conclusions being reached. Seed set was highest when the stigmas were 4–5 days old and the pollen quite fresh, the state of maturity of the stigma having appreciably less effect upon reduction in seed set than the condition of the pollen kept for various periods up to 72 hr.; a very noticeable reduction in seed setting was observed after keeping the pollen for 9 hr. Pollinating a variety by self pollen + pollen of another variety, even where the latter was used 1–2 hr. later, resulted in the formation of some hybrid grains. Pollination with pollen mixtures where self pollen was supplied by (1) the mother plant or (2) by other plants of the same variety showed that in (1) fewer hybrid grains were formed than in (2). Studies of hybrids between varieties with white and yellow grain showed that both white-grained and yellow-grained progenies of plants fertilized by foreign pollen + self pollen were more productive than the progenies from ordinary crossing of the same varieties.

3829 Zaharova, G. M.
Moştenirea caracterelor la porumb şi tomate în umra polenizării cu amestec de polen. (**The inheritance of characters in maize and tomato after pollination with mixed pollen**).
An. Romîno-Soviet. : Ser. Agric. 1955 : No. 4 : 79–94.
[Cf. XXV, 1968].

3830 Tovmasjan, O. V.
(**Inheritance of characters of two pollinators in maize**).
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 156–63. [Russian].
Sterling, a white dent maize, was pollinated (1) with Rumanian Yellow, a flint type, + Hungarian Black, a dark mauve type with white starchy endosperm, and (2) with Minnesota 13, a yellow dent type, + Sweet Black, a sweet maize with black grains. The number of white grains was greater than in pollinations with a single coloured parent, being 16·3–29·5% as compared with 0·2–5·9%. Varying shades of pigmentation were observed in the coloured grains. The white grains gave rise to plants which, when inbred, bore 6 ears bearing 14·8% coloured grains and 4 ears bearing only white grains. When plants from white grains were allowed to open pollinate they bore almost exclusively white grains. Out of 13 plants from mauve grains in the first cross, 6 bore ears containing both yellow and mauve grains when selfed; when 21 plants were allowed to interpollinate, 8 of them bore ears containing both yellow and mauve grains. The plants from mauve grains were also used to pollinate 20 plants of Sterling, three of which bore ears with both yellow and mauve grains.
In the second cross, plants from black grains when allowed to interpollinate bore ears which in 3 out of 9 cases contained both black and yellow grains. Plants from the yellow and white grains bore ears with only one type of grain.
In all cases where the characters of both pollen

parents occurred, the proportions differed in the ears of different plants.

3831 Hutchcroft, C. D.
**Contamination in seed field of corn resulting from incomplete detasseling.**
Agron. J. 1959 : **51** : 267–71.

Factors involved in pollen dispersal within a maize seed production field were studied using recessive genetic marker stocks and a dominant purple aleurone marker. Distance from contaminating pollen and date of silking accounted for much of the variability in observed contamination; twenty feet appeared to be adequate for isolation from a single tassel in order to fulfill the 1% tolerance allowed by the certification requirements. Though considerable variation occurred, between the different years studied, for the length of tassel required to exceed more than 1% contamination per plot, in all years the contamination per inch of tassel was found to be greater as the number of inches of tassel decreased.

3832 Nickerson, N. H.
**Sustained treatment with gibberellic acid of five different kinds of maize.**
Ann. Mo. Bot. Gdn. 1959 : **46** : 19–37.

Two races (Northern Flint and Zapolote Chico), two inbreds (Wisconsin CC5 and L317) and one hybrid (Spancross sweet corn) were subjected to four different concentrations of gibberellic acid throughout the growing season. The five types varied as regards the internodes affected. Tassels with pistillate florets resembling certain dominant and recessive mutants appeared among treated plants of all the types. Male sterility was also induced in each type. Treated plants of Spancross developed terminal inflorescences strongly resembling those of *Tripsacum* in organization and mode of articulation.

3833 Kurnik, E.
Szójás silókukorica termesztési kísérletek.
**(Production trials with soya bean and silage maize).**
Növénytermelés 1958 : **7** : 201–18.

At Iregszemese, Hungary, mixed sowing of maize and soya bean gave higher total yields of green matter than sowing in alternate rows. The size of the difference in yield between the two methods varied chiefly according to the maize variety used, Iregi sárga Lófogú [Ireg Yellow Dent] being the best of the four maizes tested.

3834 Åberg, E. & Åkerberg, E.
**Cold tolerance studies in maize grown under northern conditions.**
Kungl. LantbrHögskolans Ann. 1958 : **24** : 477–94.

In studies conducted at the Royal Agricultural College of Sweden in Uppsala, six varieties differing in maturity period were sown at three different sowing times. Rapidity of growth varied with variety and with sowing time, slowest growth being associated with low temperature in the first two weeks. The early variety Eagle Hill was slower in growth than the others, particularly at high temperatures. Wis. 335 was slower at low temperatures and quicker at high. Six-hour freezing periods of $\pm 0$ to $-0{\cdot}5°$ C. produced visible damage in all varieties and $-2$ to $-3°$ C. resulted in an appreciable depression of yield of green matter, plants frozen at a height of 15 cm. being more susceptible than those treated at 25 cm. KF and Wis. 335 showed the greatest frost damage. The stand of European varieties at the time of harvesting for silage, after growing under cold-spring conditions, was better than that of the American hybrids, and the germination of the European hybrids was also better.

3835 Nelson, R. R.
**The genetics of sexual reproduction in *Cochliobolus heterostrophus*.**
Phytopathology 1959 : **49** : p. 319. (Abst.)

A mutant gene *i* has been found to block the formation of protoperithecia in pairings of compatible isolates when both carry the gene. It is only known to occur in the wild-type a strains. When selfed or paired with strains of either compatibility group, certain monoascosporic isolates produced sterile perithecia in which plasmogamy is inhibited. The production of sterile asci by other strains is controlled by two additional factors, which prevent normal reduction division. It is suggested that the compatibility locus may comprise a number of closely linked genes, and that the isolates of the same compatibility group are not genetically similar at all loci involved in the sexual process. [Cf. 3815].

3836 Cappellini, R. A.
**A comparison of techniques and sites in inoculation in field corn artificially inoculated with *Gibberella zeae* (Schw.) Petch.**
Plant Dis. Reptr. 1959 : **43** : 177–79.

Inoculation methods suitable for testing resistance to *G. zeae* in corn breeding programmes

are described. Inoculation of the first four internodes showed progressively more rot from the first to the fourth in both susceptible and resistant lines.

3837 Nelson, R. R.
**A major gene locus for compatibility in *Trichometasphaeria turcica*.**
Phytopathology 1959 : **49** : 160–61.

Experiments are described indicating that *T. turcica*, the ascigenous stage of *Helminthosporium turcicum*, comprises two compatibility groups, the compatibility reaction being controlled by a single major locus. There is also some evidence for the presence of secondary genes or multiple alleles at the compatibility locus.

3838 Dietrich, S.
Untersuchungen zur Biologie und Bekämpfung von *Ustilago zeae* (Beckm.) Unger. [**Investigation on the biology and control of *U. zeae* (Beckm.) Unger**].
Phytopath. Z. 1959 : **35** : 301–32.

Collections of *U. zeae* from different localities in Germany were found to differ in their pathogenicity. In a field trial with natural infection of 11 different maizes, varietal differences in susceptibility to *U. zeae* were noticed; the most resistant varieties were Kornacker USA32 and Kornacker USA22. Late varieties suffered more stem attack than earlier varieties which were mostly attacked in the grain. Eight varieties were artificially infected as seedlings in the greenhouse; all were highly susceptible but those showing most field resistance were also most resistant in the greenhouse tests.

3839 Kulik, T. A.
**(The resistance of maize to smut).**
Kukuruza (Maize) 1958 : No. 7 : 35–36. [Russian].

Dnepr 49, Dnepr 56, Dnepr 66 and VIR 42 [Institute of Plant Industry 42] were the most resistant among the varieties tested under natural conditions at the USSR Maize Institute. Inbred lines VIR 26, 28, 40, 43 and especially G19 showed a high degree of resistance under conditions of artificial infection. The utilization of the above inbreds in breeding is advocated.

3840 Quebral, F. C.
**Anthracnose of corn.**
Philipp. Agric. 1958 : **42** : 250–63.

Seven commercial varieties of maize were inoculated with a spore suspension of *Colletotrichum graminicolum*. Five of the varieties were easily infected and killed but, although the leaves of Catambay's Cuban and I20 Sib were killed, the plants survived.

3841 **Borer-resistant corn is closer.**
Crops & Soils 1959 : **11** : No. 9 : p. 20.

At the University of Wisconsin, a chemical known as resistance factor A, conferring resistance to the European corn borer (*Pyrausta nubilalis*), has been isolated from maize tissue [cf. XXVIII, 1645–46]. Among plants of a fairly resistant inbred line, differences were found in the amount of resistance factor. This indicated that although an inbred line appears to be genetically pure, its borer resistance may still be improved. Individual plants with high levels of resistance factor can be used as breeding stock for resistant hybrids.

3842 Guthrie, W. D.
**Leaf and sheath feeding resistance to the European corn borer in dent corn.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–3425 : 1490–91. (Abst.).

The pattern of corn-borer survival was determined for eight inbreds at intervals of 5, 10, 20 and 30 days after egg hatching in a first-brood infestation under controlled conditions. Observations on leaf feeding, lesions and burrows were made 20 and 30 days after hatching. Similar data were obtained for single crosses of the inbreds. The plots were replicated six times, each being infested with about 100–120 eggs per plant. The primary objective was to determine the degrees of resistance to (1) the first and second larval instars and (2) the third and fourth larval instars, which could be transmitted from lines possessing various degrees of leaf and sheath resistance to their hybrids. Resistance to (1) was expressed as feeding damage to the leaf blade at the whorl stage of development and resistance to (2) by feeding scars on the sheath, midrib and around the collar.

On the basis of the four criteria, surviving larvae, leaf-feeding ratings and counts of lesions and burrows, the experimental inbred (W24 x B2)–2–38–1 was highly resistant to (1) and (2). Inbreds W22R and A295 also showed resistance to both (1) and (2). Oh43 was resistant to (1) but susceptible to (2), whereas Oh51A and B14 also possessed resistance to stalk invasion. WF9 and M14 were highly susceptible to all types of feeding. The most satisfactory times to record leaf-feeding ratings and number of lesions were respectively 20 and 30 days after hatching. Although the four criteria used to estimate damage were highly correlated, the data indicated that the number of larvae surviving 30

days after hatching may be a good measure of the performance of some inbreds but not of others. Leaf-feeding ratings, as an index to damage caused by (1), and lesion counts, as an index to damage due to (2), appeared to be satisfactory pointers to the performance of most inbreds. No conclusive evidence was obtained that resistance to (2) is transmitted by inbreds to their hybrids in the same manner as resistance to (1). The amount of larval establishment was much lower in the single crosses than in the inbreds. It is emphasized that in a study of this nature it is imperative to have a high level of larval establishment in order to secure the expression of factors for resistance and to elucidate their mode of transmission.

3843 Penny, L. H. & Dicke, F. F.
**European corn borer damage in resistant and susceptible dent corn hybrids.**
Agron. J. 1959 : **51** : 323–26.

Eighteen single-cross hybrids among seven inbred lines of maize were compared at three levels of first-brood infestation by *Pyrausta nubilalis*. Three of the inbred lines were considered susceptible and four resistant. The average leaf-feeding ratings of three susceptible x susceptible hybrids, nine susceptible x resistant hybrids and six resistant x resistant hybrids were 7·9, 5·1 and 2·6 respectively, and leaf lesion counts in the heaviest borer infestation for the same groups of hybrids were 5·7, 3·5 and 2·2 respectively. In general yield losses were closely related to the degree of leaf-feeding resistance of the hybrids. Two of the lines did not fit into this general pattern: crosses of the resistant N16 were similar to those of the susceptible 38–11 in yield losses, while crosses of susceptible B14 performed in a similar manner to some of the crosses of the more resistant lines. Though the use of resistant inbred lines for the production of hybrids shows considerable promise, it appears that tolerance factors also had some influence on the amount of damage caused by borer feeding and it is suggested that a combination of leaf-feeding resistance and tolerance, as in B14 x C131A, may achieve the maximum reduction in the amount of corn borer damage.

## BARLEY

3844 Eade, A. J. & Elliott, C. S.
**Spring barley variety trials, 1954-57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 342–50.

A report is presented of 59 trials, chiefly in England, to compare Glasnevin 3, Ingrid, Pirol and SAK22/11 with Proctor. Ingrid was the only variety which approached the control in yield. It was however significantly inferior in this respect and, although earlier in ripening and possessing satisfactory field characters, was below Proctor in malting quality.

3845 Fischbeck, G.
Ertragsleistung und Ertragsaufbau sowie Wachstums- und Qualitätseigenschaften führender europäischer Braugerstensorten unter süddeutschen Klimaverhältnissen, dargestellt an Hand der internationalen Braugerstenversuche 1952–1957 in Bayern. (**The yield performance, yield components and growth and quality characters of leading European malting barley varieties under the climatic conditions of southern Germany, shown by the international malting barley trials, 1952-1957, in Bavaria**).
Bayer. landw. Jb. 1959 : **36** : 131–62.

A detailed report of the above trials of 20 varieties is presented. In addition to determining yields of grain and straw, studies were made of the yield components such as 1000-grain weight and number of grains per ear and observations were made on growth characters including standing capacity. Full investigations were made of the properties determining malting quality.
Although proved German varieties are recommended for Bavaria, it is thought that some of the foreign varieties with outstanding qualities could be used advantageously in breeding new varieties for this region.

3846 Niklewski, Z.
O pewnym czynniku letalnym w jęczmieniu dwurzędowym (*Hordeum distichum*). [**On a certain lethal factor in two-rowed barley (*H. distichum*)**].
Postępy Nauk Roln. 1957 : **4** : No. 1 : 43–44.

Ears of the variety Isaria had either an even or an odd number of grains. Plants grown from seed from ears with even numbers showed an appreciably higher proportion of retarded or poor development than those from ears with odd numbers. Similar observations were made in the varieties Kazimierzowski and Borzymowski.

3847 Sawicki, J.
Metodyka wykonywania krzyżówek u jęczmienia. (**Methods of carrying out crosses in barley**).
Acta agrobot., Warszawa 1957 : **6** : 35–58.

Bonnett's method of emasculating barley by

slitting the lemma and extracting the anthers [cf. VIII, 1541] gave higher grain sets and better-filled grains than Tschermak's method of removing the tips of the lemmas and paleas. The methods were compared on both six-rowed and two-rowed barley and in crosses and self pollinations. Tschermak's method is easier, however, and is recommended where extensive parental material is available.

3848 Fesenko, N. V.
**(A physiological method of emasculating barley).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 90–93. [Russian].

This method, developed at Orel, is the same as that already described for emasculating wheat [cf. 1346].

3849 Eugster, J. & Simons, D. A.
Untersuchungsergebnisse der biologischen Wirkung der Kosmischen Strahlung (KS) auf Samen von *Hordeum* (Goldgerste) Bonus 01518/B.19 (Gustafsson) mit besonderer Berücksichtigung der Schweren Primären. [**The results of an investigation of the biological action of cosmic radiation on seeds of *Hordeum* (Golden barley) Bonus 01518/B19 (Gustafsson) with special reference to the heavy primaries**].
Arch. Klaus-stift. VererbForsch. 1958 : **33** : 1–26.

Grain of this barley was exposed to cosmic radiation during balloon flights above Switzerland and the USA. Progenies of grain which had received full hits showed various morphological aberrations such as a reduction in the total number of shoots per plant and in the number of flowering shoots. Progenies of three grains which had received full hits with heavy primaries showed a colour change in the grain.

3850 Heslot, H. & Ferrary, R.
Action génétique comparée des radiations et de quelques mutagènes sur l'orge. (**The comparative genetic action of radiations and some mutagens on barley**).
Ann. Inst. nat. agron., Paris 1958 : **44** : 133–50.

In this preliminary study, dormant grains of the spring barley Rika were treated with either $\gamma$ rays, thermal neutrons or one of twelve organic compounds thought to have a mutagenic effect. Experiments with the chemicals were of two kinds; in one method the grains were treated for three days at 3° C. and in the other for 24 hr. at 24° C. Under these two sets of conditions equal quantities of liquid were absorbed. The toxicity of the different substances was determined by assessing the dose required to kill 50% of the grains treated. Some substances were more toxic at the higher temperature than at the lower, the reverse being true in other cases. The mutagenic activity of each substance was assessed by determining the number of chlorophyll mutants produced. For the thermal neutrons the relations between frequency of mutation and the dose applied was not linear whereas for two nitrogen mustards the relationship between mutation rate and the concentration of chemical applied was linear. The mutation spectra of the chemicals, determined with reference to the percentage of *albina* mutants produced, differed markedly from those of the radiations. It is concluded that only two substances, $\beta$-chloroethylmethane-sulphonate and ethyl sulphate, are of practical use for the induction of mutations in barley; ethyl sulphate gave a mutation frequency of 10% which is twice as high as that obtained with 25,000 r. of $\gamma$ rays.

3851 Ehrenberg, L., Gustafsson, Å. & Lundqvist, U.
**The mutagenic effects of ionizing radiations and reactive ethylene derivatives in barley.**
Hereditas, Lund 1959 : **45** : 351–68.

The results presented in previous papers showing that ethylene compounds are highly mutagenic in barley have been confirmed [cf. XXVIII, 1168 and XXIX, 1205]. The frequencies of lethal, semilethal and viable mutations obtained with these compounds are much higher than those obtained with ionizing radiations. Also the mutation spectra are quite different. It has been found that X-ray induced sterility is approximately three times as common as X-ray induced chlorophyll mutation; the ratio is even higher with neutrons. However with ethylene compounds translocation sterility is relatively less frequent, the rate being about the same as or a little higher than that of chlorophyll mutation. It appears that the ability of ethylene compounds to break chromosomes is relatively less than their ability to produce gene mutation. Ethylene compounds are particularly efficient in producing viable and highly productive mutants; using these compounds, every tenth to fifth spike progeny may be expected to give rise to mutations of potential interest for breeding. With regard to both chlorophyll mutations and other viable mutations, rare types appear to be more frequent after the use of ethylene compounds than after ionizing radiation.

The mutation spectra after X ray and neutron treatments are not identical; the neutrons give a lower frequency of viable mutants but relatively more of the *erectoides* types.

3852 Gaul, H.
Über die Chimärenbildung in Gerstenpflanzen nach Röntgenbestrahlung von Samen. (**Chimera formation in barley plants after X irradiation of seed**).
Flora, Jena 1959 : **147** : 207–41.

The following hypothesis is put forward. The initial cells of the first five ears are already determined in the dormant embryo; after X irradiation there is no intercellular competition between mutant and nonmutant cells. This however is possible among the undetermined initials of later developing ears. Consequently the elimination of mutant cells is less frequent in the formation of the first ears than in the later ones. A chimera may be found within an ear when the ear arises from more than one initial cell. When new axillary buds are produced from a mutant cell, as under conditions favouring tillering, a chimera consisting of several ears arises. After receiving a strong dose of X rays, only one of the initial cells may survive and all the first five ears may develop from the same mutant initial; therefore a strong dose of X rays is likely to produce a larger mutant sector than a weak dose will provide. Also with increasing dose more of the primary axillary buds are destroyed and new ones may develop from cells originating from the initial of the main growing point; then the side shoots and the main shoot may bear the same mutation. Experimental results supporting this hypothesis were obtained using the barley Haisa II. In the first experiment 46·9% of the $X_1$ plants survived and they bore 3·2 ears per plant; the survival rate was 20% and the number of ears per plant 6·3 in a second experiment using a higher dose of X rays. Cytogenetic investigations of $X_1$ plants revealed that mutated sectors in some cases comprised a whole ear and, with about the same frequency, part of an ear. From the frequencies of mutant forms in subsequent generations it was concluded that the average size of a mutant sector in the first experiment comprised 75-80% of the flowers of an ear and in the second experiment about 100%. The frequency of $X_1$ ears with two different mutations was greater in the first experiment than in the second but only in the second experiment was there a significant frequency of plants with two or more ears with the same type of mutation. This indicated that in the second experiment more ears arose from one initial cell than in the first experiment. In both experiments, it was found that, when there was profuse tillering, fertility was improved and the frequency of point mutations in the $X_1$ ear decreased, indicating that under these conditions many mutations are eliminated as a result of intercellular competition.

3853 Kronstad, W. E., Nilan, R. A. & Konzak, C. F.
**Mutagenic effect of oxygen on barley seeds.**
Science 1959 : **129** : p. 1618.

Storage of resting seeds of *Hordeum vulgare* 'Himalaya' under an oxygen pressure of 100 lb./in.$^2$ for 4 or 6 weeks resulted in significant increases in frequencies of chromosome aberrations (dicentric bridges and acentric fragments) and seedling chlorophyll mutations, compared with the controls. The amount of cytogenetic damage increased with duration of storage. The frequencies of chromosome aberrations and chlorophyll mutations were similar to those induced by 500 r. and 1000 r. of X rays. Storage in argon or nitrogen at the same pressure failed to exert a mutagenic effect.

3854 Borg, G.
Svalöfs Original Pallaskorn (Sv 04032), nytt 2-radskorn, röntgenmutation ur Bonus. [**The Svalöf original barley Pallas (Sv 04032), a new two-rowed barley, an X-ray mutation from Bonus**].
Sverig. Utsädesfören. Tidskr. 1959 : **69** : 72–96.

The mutant *erectoides* 32, obtained by X irradiating seeds of Bonus with 7350 r. after pretreatment with 0·5% $H_2O_2$, has been named Pallas and is expected to be released in 1961. It has stiffer straw than Bonus and yields slightly more but is similar in quality. It shows a good response to favourable cultural conditions, including high nitrogen levels. [Cf. 3526].

3855 Vettel, F. & Lau, D.
Verstärkter Braugerstenanbau unter Berücksichtigung der Sortenfrage. (**Increased cultivation of malting barley with reference to the variety question**).
Dtsch. Landw., Berl. 1959 : **10** : 170–74.

The characteristics of three malting barleys grown in the German Democratic Republic are compared; mention is made of desirable improvements in malting barleys.

3856 Inamura, H.
**(Musashinomugi, an early cold-resistant barley).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : p. 1522. [Japanese].
[Cf. 2630].

3857 **New Irish feeding barley does well.**
Fm. Bull., Dublin 1959 : March : p. 7.
Banba, bred at the Plant Breeding Station, Ballinacurra, Co. Cork, Irish Republic, is shortly to be released. In the unfavourable season of 1958, it surpassed all other fodder barleys in lodging resistance and outyielded Herta, Proctor and Ingrid.

3858 Ryssdal, J.
Aktuelle byggsortar. **(Current barley varieties).**
Bondevennen 1959 : **62** : 82–86.
On the basis of trials conducted in various districts, recommendations as to the best varieties for different soil types are made. Among two-rowed varieties, Herta was particularly good. The new six-rowed variety JA 2/43 (Jadar x Asplund) is recommended as a replacement for Jadar II except on poor sandy soils.

3859 Zohary, D.
**Is *Hordeum agriocrithon* the ancestor of six-rowed cultivated barley?**
Evolution, NY 1959 : **13** : 279–80.
The author gives the following reasons in support of his view that *H. agriocrithon* is a hybrid derivative of six-rowed cultivated barley, rather than its wild ancestor. (1) Six-rowed barleys with brittle rachis, morphologically identical with *H. agriocrithon* as described by Åberg [cf. IX, 745 and XIII, p. 274] are found almost exclusively in association with natural hybrid swarms between cultivated six-rowed barley and *H. spontaneum* in Israel. (2) According to published and unpublished observations by Kamm [cf. XXV, 3051], the progeny of some of these *H. agriocrithon* plants segregated for several diagnostic characters separating this form from *H. spontaneum* and *H. vulgare*, such as brittleness *vs.* nonbrittleness and two *vs.* six rows, while several others bred true. This behaviour would be expected of hybrid derivatives from a group in which self pollination favoured fixation of recombinants. (3) The biology of seed dispersal of *H. spontaneum* is highly adapted to the steppe-like conditions under which the species grows, whereas that of *H. agriocrithon* may be considered to be inefficient. This inefficiency is probably one of the reasons why the form is unable to establish itself and is not found under truly wild conditions in Israel, although it is apparently repeatedly produced. It is concluded that *H spontaneum* should instead be regarded as the putative wild progenitor of both two and six-rowed cultivated barley. In domesticating wild barley, man had mainly to alter the biology of seed dispersal and germination. Once this was effected, selection for fertility of the lateral spikelets should have been relatively easy to acomplish.

3860 Sarvella, P., Holmgren, J. B. & Nilan, R. A.
**Analysis of barley pachytene chromosomes.**
Nucleus, Calcutta 1958 : **1** : 183–204.
The barley used for the analysis was the "short" chromosome mutant in which the chromosomes are relatively well-spaced apart at pachytene [cf. XXV, 1978]. After five generations of selfing, fertile lines were obtained which were without the numerous meiotic abnormalities found initially in the mutant but which retained the desirable condition at pachytene. Descriptions and maps are given for each chromosome. The following criteria were used to distinguish the chromosomes: (1) presence of satellites, (2) relative values for both chromomere numbers and lengths, (3) ratio between the lengths of the long and short arms, (4) pattern of chromomeres, (5) shape of terminal portions and (6) staining of fibrillae.

3861 Kivi, E. I.
Ohralajikkeittemme tähkäidännästä. **(Sprouting in the ear in our barley varieties).**
Koetoiminta ja Käytäntö 1957 : **14** : p. 7.
The susceptibility to sprouting in the ear of a large number of Finnish and foreign barley varieties and breeding lines is discussed. Among the commonly grown varieties, the tendency is much less marked in Binder than in Balder. Experiments conducted at Tammisto show that the Danish malting barley Carlsberg II is superior even to Binder in this respect.

3862 van Dobben, W. H.
Het toetsen van zomergerstrassen op gevoeligheid voor lage pH-waarden in een potproef. **(Testing spring barleys for sensitivity to low pH values in a pot test).**
Jaarboek 1958 : Med. Inst. biol. Scheikund. Onderz. LandbGewass., Wageningen 1958 : 29–34.
An account of this work has already been summarized from another source [cf. 2310].

3863 Abdallah, A. K. ['Abdullah, 'A. K.] & Omar, A. A. M. ['Umar, 'A. ul 'A.].
**A study of the relation of some morphological characters to lodging in barley.**
Ann. agric. Sci., Cairo 1957 : **2** : No. 2 : 243–47.

Study of the varieties Nabawi Abiad, Habashy 5, Beladi 16 [Local 16] and Hungary 3, representing a range in the tendency to lodge, indicated that lodging decreased with (1) higher number of vascular bundles, together with a relatively small amount of ground parenchyma, (2) bundles with small size, round shape and numerous fibres, (3) large amount of external sclerenchyma and (4) narrow diameter of the stem.

3864 Scott, K., Millerd, A. & White, N. H.
**Mechanism of resistance in barley varieties to powdery mildew disease.**
Aust. J. Sci. 1957 : **19** : 207–08.

Mildew infection in barley causes rapid collapse of mesophyll cells in resistant barleys, delayed collapse in semiresistant varieties and no collapse in susceptible varieties; in addition, a higher respiration rate occurs in all barleys prior to collapse. Extracts from infected barley were found to contain a factor capable of causing both increased respiration and, in resistant varieties, cell collapse. It appeared that on cell collapse a phenolic compound with marked fungistatic activity was released. There was evidence that susceptible barleys require a higher concentration of the respiratory factor before cell collapse can occur.

3865 Moseman, J. G. & Schaller, C. W.
**The effect on various cultures of *Erysiphe graminis* f. sp. *hordei* of the genes in barley that condition resistance to culture CR3.**
Phytopathology 1959 : **49** : 207–09.

Resistant barley varieties, each with one gene conditioning resistance to culture CR3 of *E. graminis* f. sp. *hordei*, were crossed with the susceptible varieties, Atlas and Manchuria. The reactions of the $F_3$ families to inoculation with culture CR3 were compared with their reactions to other cultures. The genes conditioning resistance to culture CR3 also conditioned resistance to certain cultures of other races of *E. graminis* f. sp. *hordei* as follows: (1) gene *Mla*2 in Black Russian to A8, 28A1, A9, R11 and CAN12; (2) *Mla*3 in Ricardo to A8, 28A1, A9, R11 and CAN12; (3) *Mlp* in Psaknon to A8, 28A1, A9, R11 and CAN12; (4) *Mlg* in Goldfoil to A8, 28A1 and A9; (5) *Mla*? in Durani to 28A1, A9, R11 and CAN12; (6) *Mlh* in Hanna to A8 and (7) *Mlk* in Kwan to 28A1 and A9. Reaction to infection can be visualized as the interaction of two independent biological systems, one in the host and the other in the pathogen. If this is true, then the gene in a variety conditioning-resistance to culture CR3 could likewise condition resistance to other cultures, provided each of the cultures lacked the complementary gene for virulence to the one gene conditioning resistance. Other genes for pathogenicity in the pathogen or for resistance in the host would not be involved in this interaction.

3866 Campbell, W. P. & Tyner, L. E.
**Comparison of degree and duration of susceptibility of barley to ergot and true loose smut.**
Phytopathology 1959 : **49** : 348–49.

Twelve varieties of barley were grown in a greenhouse, and separate groups of plants were inoculated with loose smut (*Ustilago nuda*) and ergot (*Claviceps purpurea*) on the day they first headed and at two-day intervals thereafter for ten days. Maximum susceptibility to ergot occurred as the plants first headed and all varieties were about equally susceptible at that time. Maximum susceptibility to loose smut occurred within four days of heading, but the varieties differed greatly; Trebi, Titan, Velvon and Warrior showed little if any infection on any date after inoculation. Susceptibility to either pathogen gradually decreased after heading and was generally slight after ten days. The varieties that remained susceptible to ergot longest were most susceptible in the field. Different factors apparently govern infection of the varieties by the two pathogens.

3867 Metcalfe, D. R. & Johnston, W. H.
**Breeding for resistance to loose smut in barley at Brandon.**
Cereal News 1959 : **4** : No. 1 : 3–8. (Mimeographed).

In breeding for resistant varieties, two sources of smut resistance were utilized initially, the immune variety Jet and the partially resistant variety Anoidium. Jet does not possess suitable agronomic characters but the loose-smut resistant genes have been transferred to malting varieties possessing good straw strength and yield potential, erect heads and resistance to stem rust and *Helminthosporium* (*Pyrenophora*) *teres*.

No attempt is being made to reconstitute the genotype of the recurrent malting-type parent

and it is hoped to eliminate such imperfections as tendency to shatter, weak straw and head and neck breaking. Unfortunately, these characters appear to be associated with the factors responsible for acceptable malting quality. Lines with promising malting qualities have been derived from two crosses, Meteor x Parkland[2] and Meteor x Br.4635 x UM570.
As additional genes for resistance are found, their inheritance and interrelationships are studied prior to combining them with the Jet loose-smut resistant genes. Limited tests have revealed that several additional varieties, including CI1296–1, CI3951–3, CI5798, Nigrinudum and the Valkie mutant involving the third outer glume, are resistant to a number of loose-smut races. Diallel crosses of these varieties and Jet, and crosses to the smut-susceptible variety Newal, have been made in addition to crosses between the advanced hybrid lines possessing the Jet type of loose-smut resistance and these new varieties showing the immune reaction.

3868 Chatterjee, P.
**Nature of resistance to penetration and infection of *Ustilago hordei* (Pers.) Lagerh. in seedlings of four hull-less spring barley varieties.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–2319 : p. 418. (Abst.).
Seedlings were inoculated with *U. hordei* race 6 and an Alaskan isolate and fixed and sectioned two to four days after inoculation. Spore germination and penetration of the host by the pathogen were similar in all resistant and susceptible varieties. Some anatomical changes developed in the resistant varieties after penetration. A sheath formed in the epidermal cells of the resistant varieties around the penetrating hyphae. This prevented the further penetration of the hyphae into the deeper tissues of the coleoptiles. Collapsed zones were observed very frequently in both resistant and susceptible varieties where there was a heavy inoculum on the surface of the coleoptiles. Penetration of the cells by the pathogen in or near the collapsed areas was not always seen in the development of these necrotic areas. In some cases hyphal growth was retarded without any apparent change in the host cells.
Some aminoacids, when added to the mineral nutrient agar in which the seedlings were grown, aided the fungus in establishing itself in the tissues of the resistant host. Aminoacid treatments did not change the host pathogen re-relationship for the susceptible variety.

3869 Koble, A. F., Peterson, G. A. & Timian, R. G.
**A method of evaluating the reaction of barley seedlings to infection with *Septoria passerinii* Sacc.**
Plant Dis. Reptr. 1959 : **43** : 14–17.
A technique is described for testing barley seedlings in a greenhouse where uniform expression of symptoms of infection by *S. passerinii* can be obtained. This would be of use in studying the mode of inheritance of reaction to *Septoria* leaf blotch and in screening segregating populations for resistance.

3870 Andersen, S.
**Resistance of barley to various populations of the cereal root eelworm (*Heterodera major*).**
Nematologica, Leiden 1959 : **4** : 91–98.
Two biotypes of the cereal root eelworm (*H. major*) have been found. The number of cysts on ten varieties grown in five different infected fields is given. Herta, Maja and Rex II were susceptible in all five localities. Drost, Fero and Alfa were susceptible at two places and resistant at the other three places. *Hordeum pallidum* was resistant at all five places. *H. distichum*, 16 and Kron also showed a certain amount of resistance.
Herta, Drost, Alfa and *H. pallidum* and two oats, Sun II and *Avena sterilis*, were tested on different soils for the occurrence of resistance-breaking populations. Thirty-six populations did not produce cysts on either Drost or Alfa and must consist of nonaggressive individuals. The number of cysts produced on *H. pallidum* was generally small. However, two populations caused a considerably higher number of cysts, which suggest that a biotype adapted to *H. pallidum* may be found if it can be established that the cysts are of *Heterodera major*.
In oats, resistant varieties were fewer than in barley but they were resistant to all biotypes. None was completely resistant, indicating that the resistant genes of oats are less effective than those of barley. Cysts on *A. sterilis* were developed by aggressive and nonaggressive populations.

## MILLETS AND SORGHUMS

3871 Ramchandra Rao, S.
**Millets in Andhra Pradesh.**
Krishik, Hyderabad 1958–59 : **6** : 84–87.
Information is provided on improved strains of sorghum, *Pennisetum typhoides*, *Eleusine coracana*, *Setaria italica* and *Panicum miliaceum* in Andhra and on projects of further improvement

now in progress. It is mentioned that work on the production of hybrid sorghum and *P. typhoides* has been initiated.

3872 Maslovskij, A. D.
**(Varied pathogenicity of the causal organism of millet smut, *Sphacelotheca panici miliacei* (Pers.) Bubak).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 5 : 42–44 [Russian].

A strain from Moscow proved the most virulent in trials at Har'kov, the only *Panicum* millet varieties to escape infection being VIR 1843 [Institute of Plant Industry 1843] and VNIS 29 [Beet Institute 29], which were also resistant to all other strains; M3, M4 and M9, which have been selected for resistance at Har'kov in recent years, were fairly resistant to the strains from Har'kov and Dnepropetrovsk, and moderately resistant to the virulent strains from Kiev and Barnaul.

3873 Miyaji, Y., Sakai, S. & Shih, C.-C.
**(Artificial hybridization of *Setaria italica* by hot-water treatment).**
Kagoshima Daigaku Nogakubu Gakujutsu Hokoku/Bull. Fac. Agric. Kagoshima Univ. 1955 : No. 4 : 28–37. [Japanese].

Bulk emasculation can be effected by immersing in water at 41–42° C. for 20 or more minutes, repeating for 1–2 days more if necessary. Glume movement becomes abnormal if treatments of shorter duration are applied.

3874 Madhava Menon, P.
**Occurrence of cytoplasmic male-sterility in pearl millet (*Pennisetum typhoides* Stapf and Hubb.).**
Curr. Sci. 1959 : **28** : 165–67.

The male sterility found in the variety PT819 at the Millets Breeding Station, Coimbatore, Madras, depends upon the interaction of the cytoplasm and appropriate genes. Back-cross data revealed the occurrence of fertility-restoring genes in a number of inbreds. Work on the utilization of this sterility in breeding has been initiated.

3875 Quinby, J. R., Kramer, N. W., Stephens, J. C., Lahr, K. A. & Karper, R. E.
**Grain sorghum production in Texas.**
Bull. Tex. agric. Exp. Sta. 1958 : No. 912 : Pp. 35.

The cultivation and harvesting of sorghum in Texas are briefly reviewed and an account of the breeding of varieties and hybrids is given. Mechanization of sorghum harvesting was only possible after suitable dwarf varieties had been produced. Hybrids and their parents are compared for yield, time of blooming, height of plant, time to ripen and test weight during 1957. The hybrids gave higher yields, were earlier and taller and matured more quickly than their parents. Data from a 1957 yield trial indicated that second-generation hybrids are not as high yielding as the first generation. Several types of abnormal plants appear in the fields. Some are a result of cross pollination with other varieties, Sudan grass or Johnson grass. Other abnormalities are not due to cross pollination. Tall plants may occur because of the instability of one of the genes producing dwarfness. The dwarf varieties that have Kafir in their parentage carry this unstable gene for height. Early Hegari is also unstable. Breeding work is being carried out to change the height genotype. It is not unusual to find triploid plants with almost empty heads but haploid plants are rare.
Breeding objectives are summarized. The greatest need is for improvement in standing ability and heads that will dry more rapidly after maturity so as to reduce the problems of combine harvesting. Introducing new characters, such as yellow endosperm and resistance to diseases, into varieties grown in the USA should make sorghum a more dependable and profitable crop.

3876 Davies, F. F.
**Grain sorghum hybrids recommended for Oklahoma, 1959 and performance tests of sorghum varieties and hybrids 1958.**
Misc. Publ. Okla. agric. Exp. Sta. 1959 : No. MP–53 : unpaginated.

The yield, number of days to first bloom, plant height, lodging and threshing percentage of 35 grain hybrids and 14 grain varieties are compared at six places in Oklahoma. On the basis of performance tests in 1956, 1957 and 1958, eight hybrids, RS610, RS650, Texas 601, Texas 611, Texas 620, Texas 660, DeKalb E56a and DeKalb F62a, are recommended for growing in Oklahoma. Twelve forage sorghums are also compared at each place for green and dry yield, dry matter percentage, plant height and lodging.

3877 Naldi, L.
I sorghi ibridi. **(Hybrid sorghums).**
Sementi elette 1959 : **5** : No. 2 : 44–49.

Hybrid sorghums exceed hybrid maize by 60–100% in grain yield in Italy and the forage types give two cuts of forage, with total yields varying

from 500 to 800 c. per ha. in arid areas without irrigation; dual-purpose types have given a yield of 44·50 c. of grain and 162 c. of fodder per ha.

3878 Consolani, E.
Una pianta vittoriosa contro la siccità: il sorgo ibrido da granella. (**Hybrid grain sorghum, a plant withstanding drought**).
Progr. agric., Bologna 1959 : **5** : 467–69.
Further information is provided on the satisfactory yields of the hybrid S–1 under arid conditions in Italy [cf. 2662].

3879 Barontini, F.
Il sorgo ibrido, altra grande conquista. (**Hybrid sorghum, another great conquest**).
Ital. agric. 1959 : **96** : 297–305.
Hybrid sorghums have proved well adapted to zones in Italy where the rainfall is too low for maize and in hilly districts. Of three hybrids tested in the vicinity of Pistoia in 1958, Beefbuilder gave a grain yield of 50 c. per ha. without irrigation. In other areas, also without irrigation, yields of around 100 c. are reported. $S_6$, Amak 10 and other hybrids are earlier and though their yields are lower they are suitable for late sowing or high altitudes.
In irrigated ground near Salerno, forage yields of over 915 c. per ha. were obtained.
The grain of hybrid sorghum has proved higher in protein content and lower in fibre content than that of hybrid maize and is more readily digested by livestock.

3880 Che cosa sono i Camelsorghi. (**What are the Camelsorgos ?**)
Ital. agric. 1959 : **96** : 306–07.
Several hybrid sorghums from the USA are now on the market in Italy under the name Camelsorgo and some rules are given for their successful cultivation.

3881 Musahib-ud-Din Khan
**Jowars of Dera Ghazi Khan district and hints for their cultivation.**
Agriculture, Pakistan 1958 : **9** : No. 3 : 217–21.
Local types of *Sorghum* are briefly described. Two improved varieties give high yields of grain and fodder. One of these, 100, is a leafy Bodh type with sweet, juicy stems. The panicle is large, cylindrical and compact with naked, creamy-coloured grain. The other, 263, is tall with medium thick, juicy stems, a large compact Goga-type head and creamy-white grains covered with pink glumes.

3882 **New Nebraska sorghum.**
Crops & Soils 1959 : **11** : No. 8 : p. 21.
A cross between Martin Sel. and 7078, RS608 yields 20% more than Martin, has a quick-drying head and does not lodge easily. It performs well under irrigated and dryland farming.

3883 Krishnaswamy, N., Chandrasekharan, P. & Meenakshi, K.
**Abnormal meiosis in the grain sorghums. II. The cytogenetics of the progeny of the desynaptic plant - 2.**
Cytologia, Tokyo 1958 : **23** : 251–69.
Investigations were carried out on progeny of the desynaptic type Dsy–2 ($2n = 20$) [cf. 1561]. The progeny consisted of plants with $2n = 40$ and three plants with respectively $2n = 25$, 28 and 30. From meiotic observations it was concluded that 40-chromosome plants were the result of self fertilization between unreduced gametes, while the other three originated through fertilization of gametes with 15, 18 and 20 chromosomes by reduced gametes of the normal diploid parent. The 25-chromosome and 28-chromosome plants behaved as $2n + 5$ and $2n + 8$ trisomics while the 30-chromosome individual resembled an allotriploid meiotically. In the tetraploids, the majority of the chromosomes remained unpaired at diacinesis and metaphase I. Meiosis was however normal with respect to chromosome arrangement on the equatorial plate, formation of a bipolar spindle and anaphase movement. The chromosomes passed at random to the poles. In 48·9% of the PMCs all the chromosomes were incorporated in the same daughter nucleus. In most morphological characters, the trisomics and polyploids closely resembled Dsy–2 and the normal diploid from which it was derived.

3884 Thangam, M. S.
**Twin seedlings in sorghum.**
Madras agric. J. 1959 : **46** : 93–96.
The occurrence of double seeds in AS7657 (*S. roxburghii* var. *hians*) at the Millets Breeding Station, Coimbatore, Madras, is reported. All the twin seedlings were diploid. This hybrid selection appears to be genetically unbalanced since it has also given rise to variants such as triploids, "grassy" types and striped plants.

3885 Dean, J. L. & Coleman, O. H.
**Necrotic and resistant reactions to the sugarcane mosaic virus, in sorghum.**
Plant Dis. Reptr. 1959 : **43** : 522–27.
The reactions of a large number of sorghum

varieties to sugar-cane mosaic virus at Meridian, Miss., are listed. Only a few are resistant, notably Wiley and MN2046.

## RICE

3886 Takahashi, S.
**(Early cultivation of upland rice in cool regions).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 589–92. [Japanese].
Data are provided on the vegetative rhythm and productivity of a series of direct-sown and early-transplanted upland rice varieties investigated in the prefecture of Akita.

3887 **Annual Report of the West African Rice Research Station, 1957** (1958) : Pp. 29.
Trials of the most promising varieties indicate the following to be the highest yielding. Among early varieties, Maung Nyo B24–92, Acheh Puteh and Faya gave significantly higher yields than the standard variety Lead 35. The early maincrop variety Radin China 4 gave a significantly higher yield than the standard BG79. Parn A–191 also gave higher yield than the early rice D99 and the maincrop Toma 112. Experiments on the riverain flood plains indicate the superiority there of two varieties, Nachin 11 and Haji Haroun.
Selection of improved varieties and hybridization experiments continue.

3888 **Annual Report of the Director of Agriculture of British Guiana for the year 1956.**
1958 : Pp. 66. (Mimeographed).
Breeding for high yielding, vigorous, nonlodging and nonshattering varieties of rice suited to mechanized cultivation and harvesting is continuing. Selection is also being carried out for varieties suited to transplanting and hand harvesting.

3889 Takahashi, M.
**Genetical studies on rice plant, XXII. Genes for localization of anthocyanin pigment in stigma.**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 142–48.
Data from crosses between Japanese varieties were interpreted as follows. Two genes, *A* and *Ps*, are responsible for localization of pigment in the stigma. Anthocyanin pigmentation in the stigma is however also closely dependent on the two complementary and multiple-allelic loci *S* and *Sp* for apiculus colour [cf. XXVIII, 4238]. Pigment is produced in the stigma when *A* and *Ps* occur together in the presence of any *C* and *Sp* alleles unless the *C* allele is $C^{Bt}$ or a less potent one than $C^{Bt}$, in which case the stigma is colourless. *A* has been previously described as a gene concerned with pigment production in the apiculus in particular [cf. XXVIII, 1694]. Its action has therefore now been found to extend to the stigma.

3890 Ike, T., Ita, T. & Kato, S.
**($F_2$ nursery selections from mother plants of Gimbozumidashi and some differences in their characters).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 973–74. [Japanese].
In the $F_2$ and $F_3$ generations of crosses between the above variety and two other Japanese varieties, dwarf habit behaved as a monogenic recessive to normal habit. A tendency for dwarf plants to head later and produce more panicles than the normal type was noted.

3891 Gruber, F.
Új eljárás a rizs keresztezésénél. (**A new procedure for crossing rice**).
Növénytermelés 1958 : **7** : 331–40.
An emasculation technique used at Szarvas, Hungary, is described. By breathing on to spikelets in which the yellow anther is visible through the glumes, the glumes are opened and the indehisced anthers protrude from the spikelet readily. A 60% hybrid grain set has been obtained by this method in crossing Dunghan Shali and line 45.

3892 Toriyama, K. & Futsuhara, Y.
**(Studies on rice breeding by means of artificially induced mutation. I. On the relation between tillering and mutant tissue in plants irradiated with $P^{32}$).**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 209–14. [Japanese].
The distribution of mutant tissue was ascertained by examination of the $R_2$ progeny from separately collected spikes from the various tillers arising from grains of the varieties Towada and Hatsukoda that had been treated with $Na_2HP^{32}O_4$ solution. In general, mutant tissue appeared independently in the main stem and primary tillers though, on occasion, the main stem and tillers were affected by the same mutation. Sometimes, sectorial chimerical shoots also developed. Secondary tillers were similar to the primary tillers from which they arose in respect of mutant type. Spike fertility in the $R_1$ was positively correlated with number

of fertile lines in the $R_2$ but not with number of mutant $R_2$ lines.

3893 Noguchi, Y.
**(Induction of mutation in rice by phosphorus starvation).**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 137–41. [Japanese].
Mutations affecting chlorophyll formation, awning, plant size and sterility have been induced by growing plants of three varieties in nutrient water cultures from which phosphorus was lacking except for a few weeks at the seedling stage. In another mutant of potential practical value, the panicles only emerge partially from the leaf sheaths; such plants resist lodging in strong winds.

3894 Buffa, G.
"Colosso" o "R3". **(Colosso or R3).**
Sementi elette 1959 : **5** : No. 2 : 50–53.
This rice variety, derived from a cross of Rigido Rossi [Rossi Stiff] x Precoce Rossi [Rossi Early] is possessed of extremly stiff straw and fine grain of the first quality. In normal conditions of cultivation it has yielded 87 c. of grain per ha.

3895 Piacco, R.
II.—Le principali varietà di riso. Il Maratelli. **(Principal rice varieties. II. Maratelli).**
Riso, Milano 1959 : **8** : No. 4 : 9–11.
The author discusses some of the reasons why Maratelli has lost ground recently in northern Italy in favour of other early varieties such as Razza 77 [Race 77]. A list of five other early varieties that might serve as possible substitutes for Maratelli is also given.

3896 De Beni, U.
Olmo, nuova varietà di riso fino. **(Olmo, a new variety of fine rice).**
Riso, Milano 1959 : **8** : No. 3 : 10–11.

Favero, A.
Olmo: nuova varietà di riso. **(Olmo, a new variety of rice).**
Sementi elette 1959 : **5** : No. 2 : 63–64.
The rice hitherto known as Balilla a grana grossa [Large-grained Balilla] has now been named Olmo in honour of the farm at which it was produced [cf. 2687]. It is stated to be a selection from Arborio. Last year it yielded 94·31 c. per ha. as compared with Arborio with 81·50 c. at Bologna and in other places the excess of yield over Arborio varied from 10 to 20%. The quality of the grain when cooked is also superior to that of Arborio.

3897 Suenaga, Y., Sukeno, N. & Takashima, Y.
**(The new rice varieties Chiyokai and Yamatedori).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1275–76. [Japanese].
Descriptions are given of the above two varieties, both of which are selections from crosses effected some years ago at the former Ou Research Station. The first variety, from Norin 22 [Ministry of Agriculture and Forestry 22] x Rikuu 132, matures about the same time as Rikuu 132 and has marked resistance to blast and low-temperature injury. The second variety has been described elsewhere [XXVII, 566].

3898 Nezamuddin, S. & Flora, J. S.
**Be sure you grow BR 34.**
Indian Fmg. 1959 : **8** : No. 12 : p. 13.
BR34 is an early, awnless, winter variety characterized by profuse tillering and well-filled ears with heavy, whitish grains of medium quality. It is suitable for the soil and climatic conditions of Bihar.

3899 Hardcastle, J. E. Y.
**The development of rice production and research in the Federation of Nigeria.**
Trop. Agriculture, Trin. 1959 : **36** : 79–95.
This account includes photographs showing morphological variation in the spikelets of some Nigerian varieties of *Oryza glaberrima* and other photographs of the grain of Nigerian varieties of *O. sativa*. Breeding is directed towards the development of high-yielding varieties adapted to the different zones of cultivation. In trials of introduced varieties, Mbagboli from Sierra Leone has appeared promising for riverine areas subject to deep flooding. Indigenous Nigerian varieties were collected for the purpose of making an agrobotanical classification. On the basis of this classification, a hybridization programme has begun with the object of combining the colour and quality of *O. sativa* grain with the superior adaptation of the *O. glaberrima* varieties; from 500 interspecific crosses, only 47 mature seeds were obtained and all these proved to be inviable. Shallow swamp varieties were tested at different centres. Of the varieties with a five-month growing season, the British Guiana selections D114 and D52/37 and the Indonesian MAS2401 outyielded BG79, which is the most popular variety in the Northern and Eastern Regions. Amongst later varieties tested, D99 from British Guiana, Toma 112 from Sierra Leone and PTB 16 from India have

outyielded the established varieties. Investigations on quality are also under way.

3900 Pathak, G. N. & Tyagi, O. P.
**Cytological studies in the genus *Oryza* L.**
Agric. Anim. Husb. Uttar Pradesh 1951 : **2** : Nos. 5–6 : 31–45.

This review of some of the literature deals with the origin of cultivated rice, chromosome numbers in the different species and the cytology of diploids, tetraploids, natural variants and artificial mutants.

3901 Soriano, J. D.
**X-ray-induced reciprocal translocations and chlorophyll mutations in rice.**
Bot. Gaz. 1959 : **120** : 162–65.

Presoaked grains of the *indica* variety Tjeremas were exposed to 4000 r. at the University of the Philippines, Quezon City. Of the 28 surviving plants, four were heterozygous for a reciprocal translocation. At metaphase I all the translocations appeared as a ring or chain of four chromosomes or as bivalents. No evidence of directed orientation was obtained, the alternate and adjacent orientations of rings and chains occurring in about equal frequencies. The $X_2$ progenies of the plants known to be heterozygous for a reciprocal translocation and of partially sterile plants not examined cytologically contained four types of chlorophyll mutants: *viridis, albina, xantha* and *striata* in order of decreasing frequency. X-ray treatment raised the frequency of chlorophyll mutation about 20 times above the spontaneous rate. The presence of a heterozygous reciprocal translocation was highly correlated with low seed set.

3902 Huang, C.-S. & Chang, T.-D. [T.-T.]
**(Cytogenetical studies on X-irradiated rice).**
Chung-hua Nung-hsueh Hui Pao/J. agric. Ass. China 1958 : No. 24 : 10–31. [Chinese].

Semisterile lines were obtained by X irradiation of Tai-chung 65 at doses of 10,000, 7000 and 5000 r. Most of the semisterile plants gave fertile and semisterile segregates in a 1 : 1 ratio in the next generation. One half of the fertile segregates gave fertile progeny on back crossing to the original parental strain while the other half gave semisterile progeny. Fertile and semisterile segregates appeared in a 1 : 1 ratio on back crossing the semisterile segregates to the original strain.

Cytological observations revealed the presence of ring or chain quadrivalents in the semisterile plants, which thus appear to carry single translocations. The lengths of the translocation segments were calculated. In one case the translocation involved the nucleolar chromosome. On intercrossing the translocation homozygotes, offspring with two associations of four chromosomes or one of six chromosomes were obtained. The fertility of these plants was very low (5–0%). On selfing, the double-translocation heterozygotes gave fertile (homozygotes), semisterile (single-translocation heterozygotes) and sterile (double-translocation heterozygotes) plants in a 1 : 2 : 1 ratio. The fertile segregates were mostly of normal chromosome structure but some were single-translocation homozygotes. No lethal eggs were found on back crossing the double-translocation heterozygotes as female parents to the original strain. The segregation of fertility classes was similar to that obtained on selfing.

It is concluded that interchanges are eliminated from rice populations on account of reduced fertilization capacity of the pollen.

3903 Nyst, P.
Polyploïdisation expérimentale chez *Oryza sativa*. Comparaison des principales méthodes d'induction. (**Experimental polyploidization in *O. sativa*. A comparison of the principal methods of induction**).
Agricultura, Louvain 1959 : **7** : 137–52.

Two methods involving colchicine treatment of roots and two involving treatment of stems are compared. One of the root-treatment methods gives the most rapid results but it is thought that the stem-treatment methods would be valuable if the technique were improved.

3904 Hu, C.-H.
**(Caryological studies of haploid rice plants. II. Caryotype and somatic pairing).**
Idengaku Zasshi/Jap. J. Genet. 1958 : **33** : 296–301. [Japanese].

A slightly expanded account is given of chromosome morphology and the occurrence of somatic pairing in two out of the eight haploid strains dealt with in an earlier paper [1576].

3905 Mehta, T. R.
**In search of a good early rice variety.**
Agric. Anim. Husb. Uttar Pradesh 1951 : **2** : Nos. 5–6 : 16–20.

The development of varieties combining sufficient earliness with improved yield and quality by selection and hybridization in Uttar Pradesh is surveyed.

3906 Kato, I.
**(On the sensitivity to light and temperature of rice varieties in the North-Eastern Region).**
Tohoku Nogyo Shikenjo Kenkyu Hokoku/Bull. Tohoku agric. exp. Sta. 1958 : No. 13 : 1–11. [Japanese].
The heading dates of 152 varieties were determined under five sets of conditions: (1) natural; (2) 9-hr. photoperiods; (3) 24-hr. photoperiods; (4) 9-hr. photoperiods at greenhouse temperatures; and (5) 24-hr. photoperiods at greenhouse temperatures. The varieties are classified into eight groups according to their sensitivities to short photoperiod, long photoperiod and temperature. In general early varieties were more sensitive to long photoperiods and late varieties to short photoperiods. These correlations were more apparent in Japanese than in foreign varieties. The genetic basis of sensitivity to photoperiod and temperature is explained along the lines of Fuke's six-factor hypothesis [XXVII, 576–8].

3907 Noguchi, Y.
**Studies on the control of flower bud formation by temperature and day-length in rice plants. I. Hastening of heading by high temperature.**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 247–53.
The effects of high temperature conditions (27–30° C.) and fertilization of the soil on six early-maturing varieties of rice, Norin 11 [Ministry of Agriculture and Forestry 11], Iburiwase [Iburi Early], Wasebozu [Early Bonze], Bozu 6 [Bonze 6], Kinugasawase [Kinugasa Early] and Hayashio, are described. The influence of nutrition did not appear to be important for the formation of the flower bud. However, high temperatures noticeably hastened flower bud formation; in all the varieties except Wasebozu the number of days from sowing to heading was reduced by seven to ten days.

3908 Miller, R. L.
**The inheritance of sterility in an intervarietal hybrid of rice, *Oryza sativa* L.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7339 : p. 1527. (Abst.).
Data are reported on the percentages of stainable pollen and of florets setting seed in the $F_1$–$F_3$ of a cross between two varieties (not specified) and in the parents. The data were considered to be more favourable to the hypothesis that sterility was due to structural chromosome differences than to one postulating genes conditioning fertility.

3909 Yamada, I.
**(Artificial germination of rice pollen. VIII. The relation between protoplasmic streaming in the pollen tube and temperature. II).**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 221–22. [Japanese].
Further studies on the above topic are reported [cf. 1584]. The temperatures applied were 20, 30, 38, 20→30 and 30→20° C. The optimum temperature for streaming was, as reported earlier, 30° C.; the seven Japanese varieties studied did not differ in their behaviour.

3910 Nagai, T. & Hirota, H.
**(Cultivated rice varieties from the viewpoint of root characters. I. On some ecological observations on plants left to grow in the nursery. II. Root diameter, root development and other characters.)**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 217–20. [Japanese].
Three varietal groups, I-III, based on root diameter and colour, are defined. Group I includes varieties with thick and darkly coloured roots; the values for these characters decline in passing from I to III. Japanese varieties are usually of type II or III; a number of foreign varieties and most particularly the Chinese Hsien varieties pertain to group I.
In general, varieties of type I pertain to Matsuo's varietal group B [cf. XXIV, 1119] while types II and III correspond to group C. Varieties with stouter roots tend to develop larger shoots but the ear/culm ratio is greatest in type I. Premature heading is least evident in type I but leaf tip burn is most severe in this type. Root diameter is positively correlated with resistance to the deleterious effects of reducing soils, and the varieties most resistant under these conditions produce most roots when grown in culture solutions containing hydroquinone.

3911 Oka, H.-I. & Lin, K.-M.
**Variation and selection for fertilizer response in hybrid populations of rice. Phylogenetic differentiation of cultivated rice. XVIII.**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 163–68.
Two experiments were carried out in Taiwan on hybrid populations derived from a cross between

the *indica* type Pei-ku and the *japonica* rice Tai-chung 65. In the first experiment, 25 $F_8$ lines taken at random from the bulk population were treated with (1) no fertilizer, (2) the standard amount of N, P and K fertilizers and (3) double the standard amount, and grown as first and second crops. This material had not previously undergone any artificial selection and all earlier generations had been raised with a relatively low amount of fertilizer. As indicated by data on panicle number and several other agronomic characters, the range of variation in response to fertilizer exceeded the parental range in both positive and negative directions. No correlation was detected between response and other characters, with the exception of phenol reaction. In the second experiment, $F_3$ seeds were sown in two plots and the material was grown as bulk populations up to the $F_6$, respectively with and without fertilizers. Fifty lines were then chosen at random from each plot and the $F_7$ lines were tested as a second crop for their reaction to lack of fertilizer and to a single fertilizer treatment. Lines derived from the fertilized plot tended to have a higher response and resistance to lodging than those obtained without the application of fertilizer. The significance of these results to breeding for increased response to fertilizer in *indica* x *japonica* crosses is briefly indicated. [Cf. XXVIII, 1698].

3912 Kondo, Y.
**(Studies on the resistance of rice varieties to injury by low temperature. II.).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1053–56. [Japanese].

Among the topics surveyed are: the effects of late sowing and planting, the relation between tolerance of low temperature and tolerance of cold irrigation water, the connexion between resistance to cold and to blast, and the prospects for breeding cold-resistant varieties.

3913 Oka, H. & Lu, Y.-C.
**(On the drought resistance of rice varieties).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 851–56. [Japanese].

[Cf. XXVIII, 1716].

3914 Yamaguchi, H. & Shiratori, K.
**(Some experiments on the determination of the root-rot resistance of rice varieties).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1369–70. [Japanese].

The capacity for oxidizing $H_2S$ of a series of 10 varieties was determined, this characteristic being closely associated with resistance to the above physiological disease. Oxidizing capacity was greatest in the early variety Gimmasari. [Cf. XXVIII, 4264].

3915 Chattopadhyay, S. B. & Das Gupta, C.
**Saltation in *Helminthosporium oryzae* Breda de Haan.**
Indian Phytopath. 1958 : **11** : 144–49.

Isolates of *H. oryzae* (*Cochliobolus miyabeanus*) were divisible into four groups according to the size, appearance and distribution of mutant areas in which conidial production was virtually absent. A temperature of 26° C. was the most favourable for the production of mutant areas in the culture. Mutation was also more pronounced on maize-meal agar or oatmeal agar than on Richard's agar. The few conidia produced were smaller and had fewer septa than normal ones. Reversion to the parental form of mycelium took place gradually at 21° C. upon repeated subculturing. Complete reversion did not however occur at 26° C.

3916 Chen, M.-J. [M.-C.].
**(Studies on *Acrocylindrium oryzae*).**
Nung-lin-hsueh Pao/J. Agric. For., Taichung 1957 : **6** : 84–102. [Chinese].

Four Taiwan isolates that appear to represent distinct physiological forms are described. In a test of 11 rice varieties, only minor differences in degree of susceptibility were observed.

3917 Takahashi, Y.
**(Again on the production of blast-resistant varieties. With the general idea of a resistant variety as the main topic).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1187–90. [Japanese].

This survey is concerned with distinguishing between true and apparent resistance to blast in rice and with methods of determining the nature and degree of varietal resistance.

3918 Atkins, J. G. & Todd, E. H.
**White tip disease of rice. III. Yield tests and varietal resistance.**
Phytopathology 1959 : **49** : 189–91.

White tip, caused by *Aphelenchoides besseyi*, resulted in yield reductions of up to 54·1% in the susceptible variety Early Prolific, when grown during 1954, in field plots artificially infested with laboratory cultures of nematodes. Over the three-year period, 1954–1956, yields were reduced by 17% in susceptible varieties and 7% in resistant varieties as white tip was only moderately severe in 1955 and 1956.

Twenty-eight varieties have been rated according to their reaction to white tip, under both natural and inoculated test conditions, ten being classified as resistant. Seed samples from resistant varieties grown in isolation plots, from nematode-infested seed, rarely contained nematodes. It is concluded that the severity of leaf symptoms may be used in rating the resistance of varieties to white tip.

3919 Okamoto, D. & Yasube, G.
**(Intervarietal differences in injury caused to rice by *Lema oryzae*).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1797–98. [Japanese].

The reaction of 44 varieties to infestation by the above pest was investigated. A tendency for damage to be greater in varieties with more numerous culms or leaves was noted.

3920 Best, R.
**Photoperiodism in rice.**
Field Crop Abstr. 1959 : **12** : 85–95.

In this review article the author elucidates the reasons for the many conflicting statements found in the literature and attempts to lay the basis for a more accurate analysis of varietal behaviour.

## MINOR CEREALS

3921 Grant, W. F.
**Cytogenetic studies in *Amaranthus*. I. Cytological aspects of sex determination in dioecious species.**
Canad. J. Bot. 1959 : **37** : 413–17.

*A. arenicola*, *A. tamariscinus* and *A. tuberculatus* had $2n = 32$, while the fourth species investigated, *A. palmeri*, had $2n = 34$. No heteromorphic chromosomes which might be associated with sex determination were distinguishable. Since $n$ numbers of 16 and 17 are known to occur in both monecious and diecious species, it is suggested that aneuploidy arose at an early stage in the evolution of the genus and that hybridization has promoted the genic condition necessary for the expression of diecy.

## FORAGE GRASSES

**Report of the Fifteenth Southern Pasture and Forage Crop Improvement Conference, Clemson Agricultural College, Clemson, South Carolina, June 4-6, 1958** : Pp. 52. (Mimeographed).

3922 *Owen, C. R. Problems in breeding red clover and dallisgrass linked with environment.* (*pp. 25–26*).

As the majority of clones resistant to powdery mildew (*Erysiphe polygoni*) failed to survive, because of a root rot complex in the soil, new techniques are being used in breeding for powdery-mildew resistance in red clover adapted to the Gulf coast.

A survey of dallis grass (*Paspalum dilatatum*) for variation among native clones for fertility revealed that the expression of variation in seed setting was masked by the occurrence of ergot (*Claviceps purpurea*). To overcome this, experiments were carried out during the winter and spring in greenhouses with fluorescent lighting. Heads harvested on 1 July were less fertile than those from either the 1 March or 15 April harvests. There were indications of differences between lines at each harvest and environmental fluctuations inside the greenhouse appeared to affect seed development in all lines.

3923 *Henson, P. R., Cope, W. A., Donnelly, E. D. & Burns, R. E. Inbreeding in sericea lespedeza and its relation to environment, management, irrigation, and breeding methods.* (*pp. 29–32*).

Chasmogamous flowers have been shown to be open pollinated and evidence of heterosis in the progeny of these flowers has been reported. Factors causing cleistogamous flowers appear to be seasonal, normal flowers appearing early in the flowering period. In the future, attention should be paid to producing seed in an environment where maximum cross pollination occurs.

3924 *Bennett, H. W., Taylor, N. L., McCullough, M. E. & Burton, G. W. The use of animals to evaluate the palatability of breeding lines in forage crops improvement.* (*pp. 32–34*).

Inbreeding selectively grazed spaced plants, for a number of generations, is being carried out to improve the palatability of tall fescue. Selected lines are then crossed in polycross blocks. In a replicated sod plot test, the synthetics and polycross progenies of all inbred lines except one were significantly better grazed than the variety Ky.31. In another method, selecting within the spaced plant progenies of a synthetic of eight inbred lines and four inbred lines outcrossed to Ky.31 was carried out. Only six out of the 125 lines in the test were rated as more poorly grazed than Ky.31. In addition, tall fescue has been crossed with annual and perennial ryegrass. Plants from lines originating from the $F_1$ hybrids, some of which were back-crossed for one, two or three generations to tall fescue, were compared with Ky.31 in grazing trials. One partially fertile back-cross line was extremely well grazed and a second generation

back-cross parent had 25 lines consistently better grazed than Ky.31. However, 109 lines were more poorly grazed than Ky.31. Treatment of five $F_1$ plants with colchicine so as to obtain fertile hybrids has resulted in one plant producing large quantities of viable pollen and a second plant producing limited amounts of pollen.

Significant differences in palatability between varieties of Bermuda grass and of Bahia grass have been noted.

3925 *Craigmiles, J. P. Heterosis in Sudangrass x grain sorghum $F_1$ hybrids and the status of hybrid Sudangrass.* (*pp. 34–36*). [Cf. 1557].

3926 *Harlan, J. R. Some thoughts on methods of handling apomictic species.* (*pp. 37–38*). The importance of apomixis in breeding is stressed. For example, heterosis, which occurs in some hybrid combinations, can be fixed by apomixis.

3927 Hansen, A.
Die Gras-Hybriden in der Flora Frankreichs. –Kritik und Ergänzungen. (**Grass hybrids in the flora of France. Criticism and supplements**).
Bull. Jard. bot. Brux. 1959 : **29** : 61–68.
Observations made by Camus on hybrid Gramineae occurring in France and elsewhere are critically reviewed and some additional information is supplied [cf. 1601].

3928 Hawkins, R. P.
**The classification of strains (varieties) of herbage plants.**
J. nat. Inst. agric. Bot. 1958 : **8** : 433–49.
An account is given of methods used at the National Institute of Agricultural Botany, Cambridge, England, to classify varieties of grass species into types based on growth characteristics. The work of classification is carried out in three stages: (1) preliminary screening in observation plots, (2) a more detailed study of single-spaced plants and (3) recording of variations in seasonal growth in swards. Tables are included indicating classification of 12 strains of perennial ryegrass, 14 of cocksfoot, 10 of timothy and 10 of meadow fescue into different types according to time of flowering.

3929 Raman, V. S., Chandrasekharan, P. & Krishnaswami, D.
**Note on some chromosome numbers in *Gramineae*.**
Curr. Sci. 1959 : **28** : 127–28.
The following $n$ numbers are recorded: *Themeda cymbaria, Chrysopogon zeylanicus, C. asper, C. verticellatus, Ischaemum petiolare, Pseudosorghum fasciculare,* 10; *Th. triandra,* 10, 40; *Pennisetum squamulatum,* 27; *Panicum maximum, Stenotaphrum glabrum* (*S. dimidiatum*), 18. *Th. triandra* ($n = 40$, $x = 10$) usually formed $38_{II} + 1_{IV}$. *P. squamulatum* ($x = 9$) had $25_{II} + I_{IV}$. The other species showed only bivalents.

3930 Takeoka, T.
[**Miscellaneous papers on the phylogeny of Poaceae (10). Proposition of a new phylogenetic system of Poaceae**].
Shokubutsu Kenkyu Zasshi/J. Jap. Bot. 1957 : **32** : 275–88. [Japanese].
Drawing together the proposals made in earlier papers, the author outlines his revised classification of the Gramineae, which now comprises 43 tribes arranged under five subfamilies, the Pharoideae, Arundoideae, Pooideae, Eragrostoideae and Panicoideae. Two new tribes, the Ehrharteae and Garnotieae, are defined. [Cf. XXVIII, 1734–6].

3931 Govindu, H. C.
**Physiological variation in the stripe smut of grasses, *Ustilago striiformis*.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3042 : p. 421. (Abst.)
The study of 60 single teleutospore isolates indicated that germination in *U. striiformis* was very erratic, varying with different races, different hosts and other factors. Amongst the 60 isolates, widely divergent cultural types were found. There does not appear to be a correlation between cultural characteristics and pathogenicity. The existence of a new variety, *U. striiformis* var. *holci*, has been demonstrated.

3932 Nelson, R. R. & Rogers, W. E.
**Further studies on the parasitic weed, *Striga asiatica*.**
Phytopathology 1959 : **49** : p. 319. (Abst.)
So far 67 species in 28 genera of the Gramineae have been shown to be hosts of *S. asiatica*. About 75% of all the grass species tested were parasitized. Thirteen species in the *Leguminoseae* induced seed germination, although none were parasitized. Genetic variability may exist in the parasitic capabilities of *S. asiatica*. The North Carolina strain did not attack any of the five nongramineous species tested which were previously reported as hosts. Five selections of sorghum, considered immune in South Africa, were parasitized. The formation of well-developed appressoria on the roots of soya bean and the finding of yellow-flowered *S. asiatica* in

populations of normal red-flowered plants indicate genetic diversity.

3933 SCHERY, R. W.
**Bluegrass' grassroots empire.**
Econ. Bot. 1959 : **13** : 75–84.

Northern forms of *Poa pratensis* have longer leaves with less variation in width than those of the southern forms. However, plants moved from a northern to a southern locality rapidly adapt themselves, so there is no readily apparent difference between progenies of the two forms.

3934 KLIMOVA, A. K.
**(*Poa bulbosa* L., a new promising plant for introduction into cultivation).**
Dokl. Vsesojuzn. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 6 : 10–13. [Russian].

In studies of the biology and ecology of the above plant, two distinct ecotypes were found in the province of Saratov, a xerophyte and a mesophyte, the latter being more productive under rainfed or irrigated conditions.

3935 HIYAMA, K.
**(A variety of *Poa aeroleuca*).**
Shokubutsu Kenkyu Zasshi/J. Jap. Bot. 1957 : **32** : p. 306. [Japanese].

A variety with minute retrorse pubescence of the culms and leaf sheaths is described. It is designated *P. aeroleuca* f. *matsuzawae*.

3936 BRITTON, M. P. & CUMMINS, G. B.
**Subspecific identity of the stem rust fungus of Merion bluegrass.**
Phytopathology 1959 : **49** : 287–89.

Isolates of *Puccinia graminis* from *Poa pratensis* 'Merion' were capable of sporulating on 39 species in 15 genera in five tribes of Gramineae, including *Agrostis palustris*, but they did not infect species of *Avena*, *Hordeum*, *Phleum*, *Triticum* and some others. The susceptibility of *A. palustris* and the nearly identical germpore frequencies of uredospores of *P. graminis* from Merion and from *A. alba* indicate that *P. graminis* on Merion is a physiological race of *P. graminis* f. sp. *agrostis*.

3937 COPEMAN, G. J. F. & BROWN, W. J.
**The productivity of herbage strains. 2. Cocksfoot, 1952 to 1955.**
Bull. N. Scot. Coll. Agric. 1959 : No. 6 : Pp. 24.

A detailed report is presented of a trial of the cocksfoot strains Danish Trifolium I, S37, Danish Commercial, S26, S143 and Scotia at the Grassland Experimental Centre, Muchalls, near Aberdeen, Scotland.

3938 NUR, U. & ZOHARY, D.
**Distribution patterns of diploid and tetraploid forms of *Dactylis glomerata* L. in Israel.**
Bull. Res. Counc. Israel 1959 : **7D** : 13–22.

Diploid populations occur only in typical Mediterranean habitats and are confined to relatively small areas within the tetraploid territory. Tetraploids occupy a wider range of habitats and are spread over most of the Mediterranean area of Isreal and some of the semisteppe border zone. Two diploid forms, the local *D. glomerata* ssp. *judaica* and the Iranian *D. glomerata* ssp. *woronowii*, have contributed genes to the formation of the tetraploid form. Contacts between the territories of the diploids and tetraploids are common but the boundaries are well defined with only narrow transitional belts of mixed populations. The range of morphological variation of the tetraploids overlaps considerably with that of the diploids. These results confirm the view that the two forms of *D. glomerata* should be considered only as subspecies.

3939 VAN DIJK, G. E.
**Breeding for quality in cocksfoot (*Dactylis glomerata* L.).**
Euphytica, Wageningen 1959 : **8** : 58–68.

On the basis of a survey of the literature it is concluded that the three main factors contributing to low palatability and digestibility in cocksfoot are the high lignin content, the high K/Ca ratio and the harshness of the leaves due to the presence of siliceous teeth. It is suggested that breeding for fine stems and a higher leaf/stem ratio is likely to result in a lower lignin content and that growing the plants on soils poor in lime may allow the selection of forms with an improved ability to absorb calcium. In selecting for smooth leaves at the Netherlands Foundation for Plant Breeding, a single mother plant was found which on selfing and on open pollination gave a small number of seedlings with a few vestigial teeth only. Mutual pollination of these seedlings gave 608 plants of which 260 had smooth leaves.

3940 CUANY, R. L.
**Inheritance of chlorophyll deficiencies and other genetic markers in *Dactylis glomerata* L.**
Diss Abstr. 1958 : **19** : LC Card Mic 58–2992 : p. 414. (Abst.).

Selfed progenies were analysed for potential marker trials. Chlorophyll deficiencies, which segregated from the majority of noninbred

clones, were the most frequent abnormalities. Other seedling abnormalities were harsh dwarf and broad dwarf, both under apparent genetic control. Early heading also appeared to be genetically influenced. *Alboviridis*, virescent and pale adult plants were more or less vigorous, though distinct from normal adults. Albino and *luteus* plants did not survive. These five chlorophyll variations were found to be genetically controlled. Detailed results from $S_1$ to $S_4$ generations indicated that normal plants may breed true or may segregate for only albino, or only virescent, or both types. There was no evidence of linkage between albino and virescent; the double deficient type was albino and was inherited tetrasomically with approximate ratios of 3 : 1, 35 : 1, 44 : 1 and 111 : 1. Virescent was recessive and bred true (except that some segregated for albino) and its inheritance was more complex, with ratios ranging from 2 : 1 to 100 : 1. Complementary behaviour at two loci, one tetrasomic and the other duplicate disomic may have caused the 10 : 1 ratio. Limited data indicated that *alboviridis* was recessive and inherited on a simple tetrasomic basis. Glabrousness of glumes was considered to be recessive and true breeding.
Using marker stocks as testers, outcrossing in a recombination block was over 98% even in a clone with 46% self fertility.

3941 Bradshaw, A. D.
**Studies of variation in bent grass species, I. Hybridization between *Agrostis tenuis* and *A. stolonifera*.**
J. Sports Turf Res. Inst. 1958 : **9** : 422–29.

After giving a short account of investigations on natural hybridization between the above species which he has already reported fully [cf. 409], the author draws attention to the considerable scope existing for developing improved clones for turf purposes from artificial crosses between *A. tenuis* and *A. stolonifera*.

3942 Ellerström, S.
**The co-variation of chromosome number and environment in *Phleum pratense*.**
Hereditas, Lund 1959 : **45** : 461–63.

Twin seedlings which occasionally develop in *Ph. pratense* sometimes have the polyhaploid chromosome number of $2n = 21$. From the progenies of a crossing group consisting of seven such polyhaploid plants, polyploids with $2n = 42$, 56 and 70 were selected. The seed fertility of plants with $2n = 56$ and $2n = 70$ is almost as high as that of plants with $2n = 42$. The performance of these polyploid races was compared in field trials in different parts of the Scandinavian peninsula and it was found that races reacted differently to different environments. At Notviken in northern Sweden, the 56 and 70-chromosome races produced considerably more tillers than the 42-chromosome race but this was not the case at Svalöf and Ultuna. Using the 42-chromosome race as standard, relative values for the dry-matter yield of each race in each locality were determined. These showed that the 56-chromosome race yielded less at Ultuna and more at Notviken than at Svalöf. The 70-chromosome race yielded significantly less than the standard in all three localities. In the first-year ley, this difference was less marked at Notviken than at Svalöf. There was no significant difference in yield between the three polyploid races in trials held in northern Norway. The 56 and 70-chromosome races appear to grow better under more humid conditions relative to the standard and grow better under the conditions of the northern part of the Scandinavian peninsula.
The necessity of testing artificial autopolyploids under a wide range of ecological conditions is pointed out.

3943 Nielson, A. K.
**Inheritance of combining ability for seed characteristics in *Bromus inermis* Leyss.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3012 : p. 405. (Abst.).

The performance of top-cross progenies of 18 $S_0$ clones of *B. inermis* and ten $S_1$ segregates from each and of 13 other $S_0$ clones was evaluated for two years in a replicated test. Nine varieties and synthetics were included as controls. The chief objectives were to determine the extent of variation and segregation for combining ability for seed yield, panicle number, fertility and seed weight. Mean differences among $S_0$ and $S_1$ top-crosses within families on a combined basis were significant at the 5 or 1% level for all characters, indicating extensive genetic variation for combining ability. In most cases, differences among $S_1$ top crosses within families were also significant at the 5 or 1% level in individual family analyses, thus providing evidence of segregation for combining ability. The comparison of the top cross performance of $S_0$ and $S_1$ selections suggested that one generation of inbreeding was not necessary to obtain lines superior in combining ability and, for fertility, might be deleterious. Both fertility and panicle number were shown to be important components of seed

yield. Seed weight appeared to be independent of seed yield. Heritability values, based on regression of $S_1$ on $S_0$, were 32, 38, 76 and 83% for combining ability for seed yield, panicle number, seed weight and fertility, respectively. Selection for combining ability for panicle number must be based on progeny testing. It appears possible, however, to improve combining ability for fertility by selection in clonal nurseries. Ample opportunity appears to exist for utilizing the material investigated in recurrent selection programmes and of obtaining synthetics in one or in all of the seed characters studied.

3944 Hanna, M. R.
**Fertility relationships and comparative cytology of some higher polyploids of *Bromus*, section Bromopsis.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7490 : p. 1491. (Abst.).

Data were obtained indicating that the degree of compatibility between *B. inermis* and the *B. erectus* type is sufficiently high to allow hybrids to be produced fairly readily. *B. inermis* plants were octoploids ($2n = 56$) or near octoploids. Clones of the *B. erectus* type had $2n = 56$, 59, 65 or 70. Clones of *B. pumpellianus* from Alaska were octoploid; the sporocytes of one clone contained a B chromosome. The range in chromosome number in material commonly distributed in North America under the designation *B. erectus* is probably due to interspecific hybridization in nurseries in which *Bromus* introductions are grown. Studies of microsporogenesis revealed considerable interclonal variation in degree of meiotic irregularity. Meiosis in *B. pumpellianus* was comparatively regular. Aneuploids appeared to be associated with meiotic irregularity. Most univalents formed at metaphase I appeared at anaphase I as dividing laggards. A large proportion of the half univalents reached the poles in time to become incorporated in the dyad nuclei, while the excluded laggards formed micronuclei which did not contribute appreciably to subsequent irregularities but were probably either reincorporated into quartet nuclei or absorbed into the cytoplasm before the quartet stage. Anaphase I laggards not excluded as dyad micronuclei reappeared as laggards at anaphase II, the majority forming micronuclei. Frequencies of univalents at metaphase I, anaphase I laggards, anaphase II laggards and quartet micronuclei appeared to be equally reliable as criteria of the degree of general irregularity within each clone. Significant and positive correlations between percentage of nonstainable pollen on the one hand and frequencies of univalents at metaphase I, anaphase II laggards and quartet micronuclei on the other were found in clones of *B. pumpellianus* but not in clones of *B. inermis* or of the *B. erectus* type. A significant and negative correlation between percentage of nonstainable pollen and percentage of seed set after open pollination indicated a relationship between ♂ and ♀ fertility.

3945 Timothy, D. H., Thomas, H. L. & Kernkamp, M. F.
**Combining ability in *Bromus inermis* Leyss.**
Agron. J. 1959 : **51** : 252–55.

Individual plants of five clones, their single crosses and polycross progeny were grown in a randomized block of 15 replications with two plants per plot, the clones having been selected for their contrasting characters. It was found that general combining ability was more important than specific combining ability for forage and seed yield and reaction to "general" leaf spot, bacterial blight and scald but with regard to plant height specific combining ability was the more important. The performance of clones, their average single-cross performance and polycross-progeny performance showed fairly close agreement for all the characters studied except plant height.

3946 Wit, F.
**Hybrids of ryegrasses and meadow fescue and their value for grass breeding,**
Euphytica, Wageningen 1959 : **8** : 1–12.

In attempts to intercross *Lolium perenne* and *L. multiflorum* with *Festuca pratensis*, emasculated diploid, triploid and tetraploid *Lolium* plants were pollinated with diploid and tetraploid *Festuca* in the glasshouse. Only the combinations $2n$ x $4n$ and $3n$ x $4n$ were successful under these conditions. In field experiments in which the nonemasculated parents were bagged together, the above combinations together with $2n$ x $2n$ and $2n$ x $3n$ hybrids were obtained from *Lolium* ears, while *Festuca* panicles yielded a few hybrids of the combinations $3n$ x $2n$ and $2n$ x $4n$. The $F_1$ hybrids were distinguishable from selfed *Lolium* seedlings by the rolled leaves but were not clearly distinct from *Festuca* plants before the heading stage. The triploid hybrids were intermediate in morphology of the panicle between the parents, and showed greater vigour and spring leaf production. All hybrids were male

sterile with nondehiscent anthers and showed low seed set after open pollination; a few equalled native *Festuca* types in winter hardiness. Naturally occurring triploid hybrids fell into two groups, one with branched and the other with unbranched inflorescences; most of these were male sterile. The open-pollinated progeny of both the natural and the artificial hybrids showed a marked improvement in male fertility and included a number of plants with new combinations of characters, as well as a majority belonging to the parental types. Triploid hybrids for further breeding may readily be produced on a large scale by bagging together unemasculated inflorescences of self-incompatible diploid *Lolium* plants and panicles of tetraploid *F. pratensis*.

3947 Fejer, S. O.
**Intraspecific competition as a factor in ryegrass breeding.**
NZ J. agric. Res. 1959 : **2** : 107–23.

In a study of intraspecific competition, three planting techniques were applied in field experiments. In the first experiment, designed mainly for testing general competition, groups of diallel-cross progenies of four competing perennial (*Lolium perenne*) rye-grass plants were measured. In the second experiment, a productive plant derived from perennial, short rotation ryegrass (*L. perenne* x *L. multiflorum*) and Italian ryegrass (*L. multiflorum*) types was open pollinated, giving progenies 1, 3 and 5. These were intercrossed, 1 x 3 giving hybrid 2 and 3 x 5 giving hybrid 4. These were grown and comparisons made of spaced plants, groups and single plants under competition. Attention was also paid to possible heterotic effects in hybrids 2 and 4. In experiment three, designed for aiding selection, 1 x 3 $F_2$ material was used, so as to exclude $F_1$ heterotic effects. Measurements were made on individual spaced plants and on grouped plants interplanted with clover.

These experiments show that the behaviour of selected parent plants and their progenies may be different under competitive conditions from what it is under the wide spacings used in breeding work. Significant interactions occurred between spacing and tillering and this is most marked in $F_1$ hybrids showing heterosis.

Some shortcomings of the planting techniques are pointed out, especially as regards border effects, and possible improvements were discussed. The potentialities of an "evolutionary plant breeding method" [cf. XXVI, 3310] and possible changes during seed multiplication are also considered.

3948 Griffiths, E.
**The cytology of *Gloeotinia temulenta* (blind seed disease of rye-grass).**
Trans. Brit. mycol. Soc. 1959 : **42** : 132–48.

All cells of the vegetative hyphae are uninucleate. Heterocaryons cannot therefore occur, the only sources of genetic variation being mutation and sexual recombination. The chromosome number, $n = 15$, was determined at both mitosis and meiosis. The mitotic chromosomes ranged in size from 0·25 $\mu$ to nearly 1 $\mu$, most of them being highly heterochromatic. Resting nuclei contained well-defined "prochromosomes," similar in number and size to the mitotic chromosomes. "Heterochromatic association" was a pronounced feature of both mitosis and meiosis. Nucleolar activity, as indicated by variation in size, was positively associated with cytoplasmic basophilia and was greatest in cells which may be presumed to be actively engaged in protein synthesis, viz. young vegetative hyphae and young asci. The apparent absence of the nucleolus from microconidiophores indicated that this component is not essential for nuclear reproduction. Microconidia in *G. temulenta*, as in other members of the Sclerotiniaceae, have only a sexual function. Their inability to germinate is attributed to the very low concentration of RNA in the cytoplasm, resulting from a complex pattern of cytological and cytochemical differentiation in the microconidiophores and associated cells. Nuclear behaviour in the ascus showed no peculiarities [cf. 1606].

3949 Bennett, H. W.
**The effect of temperature upon flowering in *Paspalum*.**
Agron. J. 1959 : **51** : 191–93.

In further experiments undertaken at the Mississippi Agricultural Experiment Station in connexion with the problems of interspecific hybridization [cf. 2720], plants of *P. dilatatum*, *P. malacophyllum*, and *P. urvillei* which had begun to flower were subjected for 5 days to various temperatures at 70% relative humidity with a 12-hour day. The number of florets opening in each of 10 inflorescences per plant was recorded daily during the 5-day period. At 70° F., the three species showed a flowering behaviour similar to that observed under average summer conditions. Lower temperatures caused a delay in flowering, increase in the time required for opening of the individual florets and increase in the time the anthers remained pendent without dehiscing. Light became the limiting

factor for flowering at 60° and 55° F. The three species began blooming within the same 2-hr. period at these two temperatures. *P. dilatatum* and *P. malacophyllum* did not flower below 51° F., whereas *P. urvillei* flowered at 42° F. The following technique has been used in interspecific crossing. Potted plants grown under long-day conditions (13–15 hr.) were allowed to complete the third day of flowering. On that day florets which had bloomed were removed from the plants to be used as ♀ parents and all the plants were placed in a control room (55° and 60° F.) the next day at 18.00 hr. Artificial lighting (two 500-watt Mazda bulbs) was applied the next day at 6.00 hr. After emasculation of all the florets open, the ♀ parents were removed to another room at about 80° F. The ♂ parents were then quickly placed next to the plants to be pollinated so that the racemes were in contact. The anthers dehisced within 5 min. after removal from the control room.

3950 Peters, L. V.
**Effects of hybridization between divergent types of big bluestem, *Andropogon gerardi* Vitman, and sand bluestem, *Andropogon hallii* Hack.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3774 : p. 1154. (Abst.).

The $F_1$ and $F_2$ from crosses between types of *A. gerardi* and *A. hallii* from different regions in the USA were studied with respect to seed set, seedling vigour and four morphological characters which were used to distinguish the two species. These characters were awn length, density of villous hairs on the inflorescence, colour of the foliage and amount of rhizomatous growth as determined by the basal diameter of the plant. The $F_1$s and $F_2$s were intermediate between their parents in morphological characters. It was concluded that it may be possible to develop improved varieties by combining desirable characters found in representatives of the two species from widely separated areas.

3951 **Annual Reports for 1954 and 1955 of the Frankenwald Field Research Station, University of the Witwatersrand, Milner Park, Johannesburg.**
Pp. 39 + 26. (Mimeographed).

Investigations at the above station in the Transvaal included a cytological study of *Hyparrhenia*. The following $2n$ numbers are recorded: *H. schimperi*, 40; strains of *H. hirta* from Basutoland and elsewhere, 30; and *H. aucta*, 20. Treatment of germinating seeds of (1) *H. hirta* with a saturated aqueous solution of paradichlorbenzene and (2) *H. aucta* with the vapour of this chemical resulted in crowded metaphases and chromosome stickiness or in suppression of mitosis in the primary roots. C-mitoses were absent. Cold treatment of the primary roots of the two species also failed to facilitate cytological observation. Adventitious roots of *H. aucta* treated with 8-oxyquinoline for 3 hr. showed well-dispersed but unsplit chromosomes at metaphase. After treatment for 4 hr. many metaphases with split chromosomes and a few c-metaphases were seen. Counting was however difficult because the chromosomes were not well spread.

3952 Adati [Adachi], S.
**(Fundamental studies on breeding *Miscanthus* plants as forage crops).**
Mie Daigaku Nogakubu Gakujutsu Hokuku/Bull. Fac. Agric. Mie Univ. 1958 : No. 17 : Pp. 112. [Japanese].

This comprehensive account on the above genus includes much material that has been already published [XXVII, 608, 3059–60 and XXVIII, 1750–1]. Among the topics not previously covered in detail are: variation in leaf morphology and plant habit in *M. sinensis*; caryotype analyses of the cytologically similar diploid ($2n = 38$) species *M. sinensis*, *M. floridulus* and *M. oligostachyus*, an autotriploid of *M. sinensis* var. *condensatus*, some $3x$ putative hybrids of *M. sacchariflorus*, $3x$ *M. sacchariflorus* var. *brevibarbis* in which elimination of one genome is believed to have occurred, $4x$ *M. sacchariflorus*, $5x$ *M. sacchariflorus* f. *latifolius*, a putative hybrid between the species type and *M. sinensis*, $6x$ *M. intermedius*, and various aneuploids of *M. sinensis*; and a taxonomic revision of the Japanese species of *Miscanthus*, six being now recognized.

3953 Vasileva, M.
**(The results of comparative varietal trials of Soviet varieties of Sudan grass under the conditions around Sofia).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofia 1958 : **6** : 175–86. [Bulgarian].

Dnepropetrovsk 876 outyielded two other Soviet cultivars and the Bulgarian standard variety, but was slightly less productive than Krasnodar 1967, which it exceeded, however, in earliness and hay quality; in particular it had a higher protein and a lower cellulose content.

3954 Crowder, L. V. & Michelin P., A.
La producción de las variedades de pasto Sudán, sorgos y millo "perla" en el Valle del Cauca. **(Yields of varieties of Sudan grass, sorghum and pearl millet in the Cauca valley).**
Agricultura trop. 1958 : **14** : 744–49.

Eight varieties of Sudan grass, three of forage sorghum and two of *Pennisetum glaucum* were tested at the Palmira experimental station, Colombia, in 1956–57. The sorghum MN345 was the most productive, yielding 30–50% more forage than the Sudan grass Tift. The production per cut was 22–80 tons/ha. for the former and 13–42 for the latter. MN345 was the most tolerant of drought, followed by Tift.

3955 **Caddo switchgrass for Oklahoma.**
Crops & Soils 1959 : **11** : No. 9 : p. 21.
[Cf. XXVI, 3410].

3956 Nygren, A.
**Investigations on north American *Calamagrostis*. II.**
Kungl. LantbrHögskolans Ann. 1958 : **24** : 363–68.

*C. scopulorum* ($2n = 28$) and *C. porteri* ($2n = 84$, 87) are sexual species [cf. XXV, 363]. In the former both ♀ and ♂ meioses are normal. In the latter species microsporogenesis shows pronounced disturbances such as the formation of pollen plasmodia typical of apomictic *Calamagrostis* species. *C. crassiglumis* ($2n = 140$) produces both sexual and apomictic embryo sacs. Pollen meiosis is more regular than would be expected in such a highly polyploid species. No multivalents were formed, $60–65_{II}$ and the corresponding number of univalents being observed. The single clone studied had 87·6% morphologically good pollen and a good seed set. All the available information on the chromosome numbers and mode of reproduction of North American and European species of *Calamagrostis* is summarized and briefly discussed.

3957 Nahve, Z.
**Native types of *Oryzopsis miliacea* (L.) Asch. et Schw. in Israel.**
Bull. Res. Counc. Israel 1959 : **7D** : 51–52.

Three types of *O. miliacea* indigenous to Israel have been distinguished on the basis of morphological, phenological and ecological differences; (1) a xerophytic Negev type, (2) an erect northern grey-seeded type, and (3) a semi-prostrate northern brown-seeded type. The last mentioned appears to be most suitable for pastures. It is suggested that a hardy pasture plant adapted to dry and poor habitats could be produced by crossing this northern brown-seeded type with the Negev type.

3958 **Coronado, new side-oats grama for the Southwest.**
Crops & Soils 1959 : **11** : No. 8 : p. 21.

Coronado, a new variety of *Bouteloua curtipendula* with a high forage yield, was developed at the Woodward Field Station, Oklahoma. It is superior to other varieties in size and set of seed, and seedling vigour. It yields slightly more than Tucson and substantially more than El Reno, and has a protein content comparable to that of other available varieties. It is more resistant to cold than Tucson.

3959 Gould, F. W.
**Notes on apomixis in sideoats grama.**
J. Range Mgmt. 1959 : **12** : 25–28.

*Bouteloua curtipendula* exhibits wide variation in ecological adaptation, morphological characteristics and chromosome numbers. Somatic chromosome numbers were found to range from 20, 40, 40 plus a fragment or univalent, 42, 42 plus a univalent, to 50 and to 80–102 in putative apomicts. It seems likely that plants taxonomically referred to as *B. curtipendula* have arisen through a series of hybrids between species of the section *Chondrosium*. It may be assumed that the crosses and back crosses have not only involved diploids and tetraploids but also aneuploids. All plants of the species with chromosome numbers higher than $2n = 52$ are obligate apomicts. By measuring pollen size and variability, a survey was made of the incidence and distribution of plants with high chromosome numbers and apomictic reproduction. Apomicts with larger pollen grains than sexual plants were found to occur in a broad well-defined zone from north-eastern Mexico to the south-western USA.

3960 Bogdan, A. V.
**Flowering habits of *Chloris gayana*.**
Proc. Linn. Soc. Lond. 1959 : **170** : 154–58.

Information is given on the flowering habits of *Ch. gayana*, as observed under conditions at the Kitale Grassland Research Station, Kenya. The relative position of the stigmas and anthers indicates that the stigmas are more likely to receive pollen from the higher-placed panicles than from the racemes of the same panicle, geitonogamy and even xenogamy thus being suggested. Data from bagged and open-pollinated panicles and from a preliminary progeny test also suggested that the species is predominantly xenogamic.

3961 TRONICKIJ, N. A.
**(The hybrid origin of plant species).**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 360–62. [Russian].

After a brief reference to the views of early writers such as Linnaeus, Darwin, Lotsy and Popov concerning the role of hybridization in evolution, the author describes some plants found in Georgia in 1927 which showed a range of characters intermediate between *Agropyron cristatum* and *A. repens*, many of them being indistinguishable from *A. sibiricum*. Similar plants were later found in Armenia in areas where *A. cristatum* grows together with *A. intermedium* and *A. trichophorum*. Some of them had a chromosome number of $2n = 42$, as opposed to the usual number of $2n = 14$ or 28 in *A. cristatum* and the view is expressed that *A. sibiricum* is a hybrid species.

3962 CAUDERON, Y.
Étude cytogénétique des Agropyrum français et de leurs hybrides avec les blés. **(A cytogenetic study of French *Agropyron* species and of their hybrids with wheats).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 389–566.

The literature on *Agropyron* is surveyed and eight species and subspecies naturally occurring in France are described. These are: *A. elongatum*, ($2n = 14$); *A. caninum*, ($2n = 28$); *A. junceum* subsp. *boreo-atlanticum*, ($2n = 28$); *A. junceum* subsp. *mediterraneum*, ($2n = 42$); *A. repens*, ($2n = 42$); *A. littorale*, ($2n = 42$); *A. intermedium*, ($2n = 42$) and *A. campestre*, ($2n = 42$). Information is provided on the distinguishing morphological features of representative clones of each species or subspecies, their geographical distribution being also mentioned. There are also some natural hybrids with $2n = 35$, 42 or 49.

Observations on chromosome morphology are reported, differences between species having been noticed. Meiosis was studied in PMCs. *A. caninum* and *A. elongatum* showed typical diploid behaviour but quadrivalents were found in the other six species, indicating the existence of partial autotetraploidy, the number of quadrivalents being too small for complete autotetraploidy. These six species show good fertility and stability. The following hybrids were also studied: *A. campestre* x *A. repens*, ($2n = 49$); *A. junceum* subsp. *mediterraneum* x *A. campestre*, ($2n = 49$); *A. junceum* subsp. *mediterraneum* x *A. littorale*, ($2n = 49$); *A. junceum* subsp. *mediterraneum* x *A. intermedium*, ($2n = 42$); *A. campestre* x *A. intermedium*, ($2n = 48$ and 49) and *A. intermedium* x *A. littorale*, ($2n = 42$). Morphological characters of the hybrids are compared with those of the parents; all the $F_1$s showed marked heterosis. The high frequency of chromosome pairing at meiosis indicated that both autosyndesis and allosyndesis occurred; bivalents and multivalents were noticed. Various anomalies, including lagging univalents, were observed at other meiotic stages and hardly any normal pollen was produced. Two clones of the natural hybrid, *A. acutum* (*A. duvalii*), with $2n = 35$, showed complex meiotic configurations, including chain associations and many fragments and bridges. Two clones with $2n = 42$ showed similar behaviour. This hybrid is supposed to be a cross between *A. junceum* and a hexaploid *Agropyron*, probably *A. littorale*. *A. tallonii*, another natural hybrid, presumed to be *A. campestre* x *A. repens*, has $2n = 49$ and is sterile, but the frequency of chromosome pairing is greater than that in experimental hybrids between *A. campestre* and *A. repens*.

From all these studies it appears that considerable homology exists between the chromosomes of different species of *Agropyron*. It is probable that only a small number of diploid species were involved in the development of the polyploid forms. Taking into account the conclusions of other investigators, the following haploid genome formulae are put forward: *A. elongatum*, E; *A. caninum*, S (from *A. spicatum*) and X (of unknown origin); *A. junceum* subsp. *boreo-atlanticum* $J_1J_2$, the two genomes being closely related and originating from an unknown diploid species; *A. junceum* subsp. *mediterraneum*, $J_1J_2E_3$; *A. intermedium*, $E_1E_2N_1$; *A. campestre* $K_1K_2E_4E_5$, where K may be related to N; *A. littorale*, $N_2N_3Y_1$, Y possibly being related to J; and *A. repens*, $R_1R_2Z_1$, the origin of R and Z being unknown and one of them being related to K.

Of the many hybridizations attempted between *Triticum* and *Agropyron* species, the following were successful: *T. timopheevi*, *T. dicoccum*, *T. persicum* var. *rubiginosum* and *T. durum* var. *mahmoudi* with *A. intermedium*; *T. timopheevi* and *T. dicoccum* with *A. campestre*; several varieties of *T. vulgare* with *A. intermedium*; and *T. vulgare* 'Progress' x *A. elongatum* (10*x*) and the reciprocal cross. All the hybrids are perennial and resemble *Agropyron* rather than *Triticum*; they are on the whole very vigorous and sterile. The $F_1$s of *T. timopheevi* x *A. campestre* and *T. dicoccum* x *A. campestre* have not been previously described and so their

distinguishing characters are compared in detail with those of the parents. Most of the chromosome associations observed in the $F_1$ were rod bivalents. Hybrids between wheats with $2n = 28$ and *A. intermedium* showed 0–7 bivalents arising principally from autosyndesis between *Agropyron* chromosomes. Bivalents were more frequent in the $F_1$s between 28-chromosome wheats and *A. campestre*, up to 14 bivalents being observed; about half of these were rings. Autosyndetic associations of *Agropyron* chromosomes were also observed in $F_1$s of 42-chromosome wheats x *A. intermedium*. There was also some indication of allosyndetic pairing in these hybrids. On the whole it appeared that there was not much homology between the chromosomes of the *Agropyron* and *Triticum* species studied. Only one hybrid, *A. elongatum* (10*x*) x *T. vulgare* 'Progress', gave a few grains on selfing. $F_1$ hybrids of *T. vulgare* varieties with *A. intermedium* were back crossed to *T. vulgare* and a very low seed set was obtained. Most of these grains originated from unreduced female gametes. The back-cross plants were perennial but morphologically more like wheat than the $F_1$. Plants of (Vilmorin 27 x *A. intermedium*) x Vilmorin 27 were studied cytogenetically. Two $F_1$ plants of this back cross had $2n = 64$ and showed metaphase configurations of $21–28_{II}$, there being 21 pairs of *Triticum* chromosomes and 0 to 7 pairs of *Agropyron* chromosomes. A few trivalents and quadrivalents were also observed; these may have been allosyndetic associations between wheat and *Agropyron* chromosomes. These two $R_1$ plants showed other meiotic abnormalities, including lagging univalents, heterozygote inversion bridges and micronuclei. Nevertheless these plants were very fertile. Grain obtained by selfing developed into viable plants rather heterogeneous in form. Most of the resulting plants were perennial and fertile but fertility varied between plants. It is thought that in successive generations the chromosome number would become stabilized at $2n = 56$, the genome formula being ABDE. A second back cross to wheat seems to be necessary to obtain 42-chromosome types. When *T. vulgare* 'Progress' x *A. elongatum* (10*x*) and the reciprocal cross were back crossed to Progress, the $F_1$s had 48 and 61 chromosomes respectively; they had originated from partially reduced female gametes. Both plants showed irregular meiosis and reduced fertility.

Amphidiploids were obtained by colchicine treatment of $F_1$ hybrids. The amphidiploids of *T. timopheevi* x *A. intermedium* showed considerable variation in chromosome number and many univalents were observed, whilst 60% of the amphidiploids of *T. dicoccum* x *A. intermedium* had $2n = 70$. These amphidiploids showed some meiotic abnormalities but were vigorous and fertile. However, the amphidiploid *T. vulgare* x *A. intermedium* is weak and almost completely sterile.

From all these studies, it is concluded that *Agropyron* species in France form quite a homogeneous group; together they constitute a taxonomic unity; severally, they may each be regarded as cenospecies as defined by Clausen, Keck and Hiesey. *A. caninum* is however more closely related to *Hordeum* and *Elymus* than to other *Agropyron* species, with which it never crosses. The *Agropyron* species occupy a central position in the Hordeeae, linking *Hordeum* and *Elymus* to the *Triticum* species. Diploid wheats are not closely related to *Agropyron* but *A. intermedium* and *A. campestre* appear to be quite close to the tetraploid wheats.

Before using *Agropyron-Triticum* crosses in breeding, it is thought necessary to carry out a selection programme with *Agropyron*.

3963 Tsitsin [Cicin], N. V. & Lubimova, V. F.
**New species and forms of cereals derived from hybridization between wheat and couch grass.**
Amer. Nat. 1959 : **93** : 181–91.

Studies carried out at the Principal Botanic Garden, Moscow, USSR, showed that all species of wheat cross relatively well with the *Agropyron* species *A. glaucum* ($2n = 42$), *A. elongatum* ($2n = 70$), *A. junceum* ($2n = 42$), *A. trichophorum* ($2n = 32$) and a Siberian variety of *A. repens* ($2n = 42$). The most valuable hybrids have been obtained by crossing *T. durum* and *T. vulgare* with *A. glaucum* and *A. elongatum*. Both species of *Agropyron* are polymorphic and yield many different hybrids. As a result of such hybridization, new winter and spring varieties of *T. aestivum* and new species of *Triticum* have been produced; these include the perennial wheat *T. agropyrotriticum* var. *perenne* and various forms of the forage wheat *T. agropyrotriticum* var. *submittans* [cf. 2410–26].

3964 Skalický, V. & Jirásek, V.
Taxonomické a nomenklatorické poznámky k třídění rodu *Agropyron* Gaertn.
**(Taxonomic and nomenclatural remarks on the classification of the genus *Agropyron* Gaertn.).**
Preslia 1959 : **31** : 44–48.

The authors disagree with Nevskij's revision of the genus *Agropyron*; they consider that the

perennial species *A. cristatum* and *A. pectinatum* should be separated from the annual species and placed in another genus for which the oldest valid name is *Kratzmannia*. The European species of *Kratzmannia* are revised.

## LEGUMINOUS FORAGE PLANTS

3965 Buller, R. E. & Valdivieso G., R.
Comportamiento de leguminosas forrajeras en los Valles de México y de Toluca. (**Performance of forage legumes in the Valleys of Mexico and Toluca**).
Foll. téc. Secretaría Agric. Ganad., Méx. 1958 : No. 34 : Pp. 20.

In Mexico Valley, four lucerne varieties, four red clovers, Ladino clover, *Lotus corniculatus* and *L. tenuis* were tested during 1955–57. Lucerne was superior to the other species in forage yield, ease of establishment, winter production and number of cuts per year, Oaxaca being the best variety. Of four lucernes, two red clovers, Ladino clover and Alsike clover, tested in Toluca Valley, Kenland medium red clover was best over a period of four years. The lucernes were similar in yield to red clover in the first year but fell off in the second and later years.

3966 Bőjtös, Z.
A lucerna nemesítése és termesztése. (**Lucerne breeding and production**).
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 159–65.

Breeding in Hungary is based on local material adapted to the continental climate and soil conditions of the country. Cross pollination in lucerne is facultative, and since inbreeding depresses yields of both fodder and seed, self-sterile but interfertile strains are used as parents. Hybrids of parents selected from lines inbred for two generations did not show greater vigour than those from open-pollinated parents. A low positive correlation for yield of fodder was obtained between parents and their selfed progeny. A synthetic variety developed in 1957 at Martonvásár exceeded the best local varieties in yields of green matter, dry matter and protein in tests conducted in 1958.

3967 Johansen, Ø.
Valg av lusernestammer. (**Choice of lucerne strains**).
Samvirke 1959 : **54** : 150–51.

In trials conducted at Vidarshov in Norway, Grimm and Rhizoma have performed equally well. The Swedish strain Tuna has shown promise.

3968 Stanford, E. H.
**The zebra leaf character in alfalfa and its dosage-dominance relationship.**
Agron. J. 1959 : **51** : 274–77.

The zebra-leaf character in lucerne is dependent on a single tetrasomic gene with dominance at the duplex level. Segregation ratios for the tetrasomic duplex system resemble those for the disomic recessive suppressor system but the two can be differentiated by growing selected $F_4$ families, as under disomic inheritance the normal plants in a 1 normal : 3 zebra $F_3$ family would all breed true when selfed, while in the tetrasomic case the normal plants from a 1 : 3 family would segregate 3 normal : 1 zebra. The tetrasomic duplex system differs markedly from the simplex system in the proportion of dominant plants in successive generations of inbreeding. This would be reflected in a different rate in the decline of hybrid vigour in inbred populations.

3969 Wilson, M. L., Melton, B. A. & Watson, C. E.
**Zia alfalfa.**
Bull. N. Mex. agric. Exp. Sta. 1959 : No. 435 : Pp. 15.

Zia, a new synthetic variety originating from New Mexico Common, Turkistan and Lahontan, is resistant to *Therioaphis maculata* and also possesses good resistance to *Corynebacterium insidiosum* and *Fusarium solani* (*Hypomyces solani*). It begins to grow at about the same time as New Mexico Common, is more vigorous and recovers more quickly after cutting than New Mexico Common or New Mexico 11–1. It is of the "common" type, upright in growth and has a very wide crown. In yield trials, which included New Mexico Common, Zia was the superior variety.

3970 Bannerot, H.
Possibilités d'utilisation de l'analyse séquentielle pour le contrôle des variétés-populations. (**Possibilities of using sequential analysis for the control of variety populations**).
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 59–74.

In identifying local and synthetic strains, the frequency of characteristic phenotypes such as the variegated flowers of lucerne is compared with that of standard samples. It is shown how sequential analysis may be used to determine whether a certain character occurs with a frequency greater or lower than the standard

value when using only a small sample of the strain to be identified.

3971 Sprague, E. W.
**Cytological and fertility relationships of *Medicago sativa*, *M. falcata*, and *M. gaetula*.**
Agron. J. 1959 : **51** : 249–52.

Single and complex crosses made from the diploid forms of *M. sativa*, *M. falcata* and *M. gaetula* displayed regular meiosis. The genomes of the three species were shown to be homologous by regular chromosome pairing in the different hybrids. The morphology of the somatic chromosomes of the three species was found to be identical, with each species having one pair of chromosomes with satellites. The cross fertility was greater than the self fertility in every population observed. The percentage of viable pollen varied significantly between plants and between replications, but no association of fertility and percentage of stainable pollen was found. This suggests a pronounced influence of environment on pollen viability. It was concluded that cytologically these three diploid species are variations within one polymorphic species.

3972 Dotzenko, A. D. & Dean, J. G.
**Germination of six alfalfa varieties at three levels of osmotic pressure.**
Agron. J. 1959 : **51** : 308–09.

The germination of seeds of six varieties decreased as the osmotic pressure was increased. The ability to germinate at high osmotic pressures appeared to be heritable. The varieties African and Caliverde showed the least, Buffalo, Vernal and Ranger the greatest decrease in germination. Lahontan seemed to be intermediate.

3973 Jurgelsky, W. (Jun.)
**The variation, interrelationship and heritability of carotene, xanthophyll, nitrogen and certain agronomic characters in alfalfa.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–5687 : p. 1175. (Abst.).

A group of selected clones was studied with respect to natural variation in contents of nitrogen, carotene and xanthophyll, yield, percentage dry weight and "days to maturity", and the heritability and interrelationships of these characters. The magnitude of the variation was indicative of scope for selection. The data on interrelationships did not suggest that any major difficulty would be encountered in selecting for high nutrient content, high yield, succulence and earliness. High content of nitrogen appeared to be of value as a criterion in selecting for high contents of carotene and xanthophyll, low dry-weight percentage and earliness. In general, a parent high in nitrogen, carotene or xanthophyll content tended to give $F_1$ progeny higher in values for these constituents than $F_1$ progeny from a parent with lower contents, in crosses with the same or comparable clones.

3974 **Alfalfa varieties being selected for drouth, cold.**
Crops & Soils 1959 : **11** : No. 8 : p. 19.

Drought resistance is being determined at the Colorado State University by applying mannitol solution to the germinating seed of different varieties. Any strain which germinates under these conditions is considered to be drought resistant and is then tested for cold by keeping the seedlings at 10° F. for 48 hours. Seeds from Buffalo, Ranger and Vernal have shown the greatest promise so far.

3975 Schmiedeknecht, M.
Beitrag zur Eigenschaftsanalyse der Resistenz verschiedener *Medicago*-Arten gegen *Pseudopeziza medicaginis* (Lib.) Sacc. [**A contribution to the analysis of the properties of resistance to *Ps. medicaginis* (Lib.) Sacc. of different *Medicago* species**].
Züchter 1959 : **29** : 65–72.

The reactions of 20 species and subspecies of *Medicago* to *Ps. medicaginis* f. sp. *medicaginis-sativae* and f. sp. *medicaginis-lupulinae* are described. Active resistance to the pathogen included a defensive reaction of the cytoplasm. In some cases this inhibited the development of the fungus and the strongest reactions prevented germination of the spores on the epidermis. Weaker reactions were only able to localize the pathogen in the tissues. Cytoplasmic reaction was immediate in effect and specific; for example *M. sativa* showed a weak cytoplasmic reaction against *Ps. medicaginis* f. sp. *medicaginis-sativae* but a strong reaction to f. sp. *medicaginis-lupulinae*. Epidermal cells showed a stronger cytoplasmic reaction than palisade cells. Another specific reaction found in some forms of *Medicago* involved thickening of the epidermal cell walls. Less specific and often somewhat delayed in appearance were the hypersensitive reactions; most host plants showed similar hypersensitive reactions to both forms of the pathogen. One form of this reaction was necrotic and varied between slight discoloration of the cells and coagulation of the cytoplasm. The second form involved the development of a brown encrustation of the walls of epidermal cells surrounding an infected area.

This gummose substance was not formed in the guard cells so that the pathogen was able to break through the barrier by way of these cells. The forms of *Medicago* investigated showed these four types of reaction in varying strengths and combinations. *M. rigidula* was the only species immune to both forms of the pathogen.
It is thought that it would be worth while to introduce additional resistance into cultivated lucerne by means of suitable interspecific crosses.

3976 Ward, C. H.
**Reliability of the detached-leaf technique for testing alfalfa clones for resistance to black stem.**
Phytopathology 1959 : **49** : p. 229. (Abst.).
Seventy-two clones of differing degrees of resistance to *Ascochyta imperfecta* were used for comparative tests in the field, greenhouse and laboratory. Plants in the field and greenhouse were inoculated and disease severity was recorded ten and seven days respectively after inoculation. In the laboratory, disease records were made on detached leaves four or five days after inoculation. Disease records did not differ greatly, as indicated by correlation analyses, when the same clones were inoculated in the field or in the greenhouse, or when leaves detached from the clones were inoculated in the laboratory. For this reason, the detached-leaf technique is considered reliable.

3977 Mihatsch, H.
Beitrag zur Kenntnis einer Welkekrankheit der Luzerne unter besonderer Berücksichtigung der Sortenanfälligkeit. (**A contribution to knowledge of a wilt disease of lucerne with special reference to varietal susceptibility**).
NachrBl. dtsch. PflSchDienst., Berl. 1959 : **13** : 22–29.
In field trials with a series of varieties of lucerne, differences were observed in reaction to infection with *Verticillium albo-atrum*. The variety Pegau, which came from the cross *Medicago sativa* x *M. falcata*, was apparently immune, producing a good stand in the third year of cultivation when other varieties were in a very poor condition. The apparent immunity of Pegau may have been the result of its good capacity for growth and regeneration; however the variety is rather slow growing in the young stages.

3978 Rode klaver, 1959. (**Red clover, 1959**).
Landbouwvoorlichting **16** : Bijl. 47; Ber. Rassenkeuze 1959 : No. 264 : Pp. 7.
Tabular data on yields of green and dry matter, crude protein, hardiness and earliness are presented for varieties included in the Netherlands official varietal list [XXVIII, 3574] and for a few varieties still in the trial stage. Further comparative data are given for yield, hardiness and earliness in Netherlands trials of 68 varieties from 21 countries.

3979 Caputa, J.
Étude des variétés de trèfle violet (*Trifolium pratense* L.). [**A study of red clover varieties (*T. pratense* L.)**].
Schweiz. Landw. Mh. 1959 : **37** : 199–205.
The results are reported of trials held at stations in French-speaking Switzerland; 17 varieties originating from six countries were tested. The Swiss varieties Changins and Leisi were best adapted to conditions in the Swiss plains but Scandinavian varieties gave the best results in the mountains. In another trial of several Swiss types of red clover, marked differences in yield were obtained. It is suggested that existing stocks of red clover should be improved both by selecting plants adapted to Swiss conditions in the plains and mountains and by hybridization with Scandinavian types.

3980 Lielmanis, J.
Panākumi sarkanā āboliņa selekcijā. (**The results of breeding red clover**).
Augsne un Raža, Rīgā 1958 : **7** : 241–51.
Stendes vēlais II [Stende Late II] is distinguished by high yield, great winter hardiness, longevity and resistance to fungi. It was obtained at Stende by intercrossing superior families which had been selected from adapted Latvian land races.

3981 Sokol'skaja, B. P.
**(Biological and economic characteristics of open pollinated red clovers).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 63–67. [Russian].
An account is given of experiments at the Ivanovo Breeding Station on open pollination involving many land races and cultivars, the latter including the distant ecotypes Altaj 216 and Mamontov. The yield of seed and green matter of most forms was greatly improved after open pollination for a few years. In some cases the treatment resulted in an elongation of the corolla tube though this was too slight to render pollination by bees difficult. Mention is made of Ivanovo 15, which was obtained by the above method aided by selection. It is highly productive of seed and forage.

3982 Bain, D. C.
**Selection for resistance to root knot of white and red clover.**
Plant Dis. Reptr. 1959 : **43** : 318–22.

Inoculation tests at the Mississippi Agricultural Experiment Station of selected seedlings of white and red clover with *Meloidogyne incognita* and *M. incognita* var. *acrita* indicated the presence of factors for resistance.

In the first generation of white clover seedlings resistance to *M. incognita* var. *acrita* was greatest in sibbed progenies 27–2 and 27–11 of the Swedish selection PI195484. Another Swedish selection, PI195485, gave greatest resistance to *M. incognita* in its sibbed progenies 28–3 and 28–2. Second-generation selections from open-pollinated 27–11 were resistant in comparison with control varieties but to a lesser degree than the first generation.

Greatest resistance in red clover to both pathogens was obtained in the sibbed progeny 19–3 x 19–7 (FC24094) and in the open-pollinated 24–2 (FC24013). The reciprocal cross 19–7 x 19–3 gave many more susceptible seedlings, suggesting the possibility of cytoplasmic influence on the inheritance of resistance.

3983 Beke, F.
Vöröshere nemesítése és termesztése. **(Red clover breeding and production).**
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 167–71.

In Hungary, lack of persistence in red clover for more than two years is attributed chiefly to virus attack and to a lesser extent to the effects of drought, frost, aging and soil conditions. Breeding for virus resistance has therefore been initiated at Sopronhorpács and Fertőd. Resistance was found in 16 out of 8700 plants and proved to be a recessive character. Breeding methods used include the polycross method and recurrent selection.

3984 Emery, D. A.
**Relation of seedling characteristics to persistence in red clover *Trifolium pratense* L. and estimates of heritability.**
Diss. Abstr. 1959 : **19** : LC Card Mic. 58–7478 : p. 1503. (Abst.).

[Cf. 180].

3985 Ziegenbein, G.
Anbauwürdigkeit verschiedener Ladinosorten. **(The agronomic value of different Ladino varieties).**
Mitt. dtsch. LandwGes. 1959 : **74** : 426–29.

Sixteen white clover varieties including 11 American Ladino types and two Italian Ladino clovers were tested at Bad Hersfeld in Federal Germany. Varietal differences in a number of morphological characters were noticed. The American Ladinos were superior to the Italian in height, leaf size and production of runners. During the first year's growth, only small differences were found between Ladino varieties in respect of their general performance. All the varieties tested were greatly damaged during the winter. Varieties of low growth habit withstood the winter better than the taller types; Steinacher was the most winter hardy. When classified according to the yielding capacity shown over a three-year period, none of the American Ladinos came in the first class; the best varieties were NFG Gigant, Aberystwyth S100, Steinacher and the so-called Ladino type Ac50, from New Zealand. There appeared to be marked varietal differences in capacity for regeneration and longevity.

3986 Rossiter, R. C.
**The influence of maturity grading on total yield and seed production in strains of *Trifolium subterraneum* L. grown as single plants and in swards.**
Aust. J. agric. Res. 1959 : **10** : 305–21.

Many strains were grown as single plants and in swards in a series of one-year experiments at Kojonup, Western Australia. In the case of spaced plants, total yield (herbage + burr) and seed yield increased linearly with increasing maturity grading (time taken from sowing to commencement of flowering relative to the early strain Dwalganup). With swards, total yield showed scarcely any relationship with increasing maturity grading, while seed yield declined rapidly. Thus, Dwalganup gave the lowest seed yields in single-plant plots but the highest seed yields in swards, whereas the reverse situation held for the late strains Wenigup and Tallarook. The main factor responsible for the disparities in pattern of production was considered to be available soil moisture.

3987 Saubert, S.
**Strain variation and host specificity of *Rhizobium*. I. *Rhizobium leguminosarum*.**
S. Afr. J. agric. Sci. 1958 : **1** : 451–55.

The 17 rhizobial strains tested on *Vicia* species and varieties differed markedly in their effect on the growth and nitrogen content of the host plants, exhibiting not only selectivity with regard to different species but also with regard to different varieties of the same species.

3988 Donnelly, E. D. & Hawkins, G. E.
**The effects of stem type on some feeding qualities of sericea lespedeza, *L. cuneata*, as indicated in a digestion trial with rabbits.**
Agron. J. 1959 : **51** : 293–94.

Certain *Lespedeza cuneata* plants have more pliable stems which are smaller in diameter than the normal rigid, coarse-stemmed type. Ground, fine and coarse stemmed forage was fed to rabbits and the results compared. Rabbits consumed more of the fine-stemmed type which contained more total digestible nutrients, crude fibre and nitrogen-free extract and was therefore more palatable and provided more energy than the coarse-stemmed type. The coarse-stemmed type contained more ash than the fine-stemmed type, and the digestibility of the ash was considerably higher in the former. No difference was indicated in digestibility of the crude protein and cellulose in the two diets.

3989 Cope, W. A.
**The lespedeza hunt.**
Res. & Fmg. 1959 : **17** : No. 3 : p. 13.

Brief mention is made of work in North Carolina improving the yield, shortening the time to maturity and increasing the resistance of lespedeza to root-knot nematode and tar spot (*Phyllachora lespedezae*) by introducing new varieties, developed from the most promising current experimental lines. One very late strain, which gave yields more than 30% higher than Climax, also has a high tar-spot resistance.

3990 Shastry, S. V. S.
**Embryological and cytological studies in the genus *Melilotus*.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3856 : 648–49. (Abst.).

In the cross *M. suaveolens* x *M. alba*, seed abortion occurred within 14 days after pollination. The primary cause was slow growth of the endosperm, cell-wall formation and differentiation into a peripheral layer of absorptive cells being impeded. Seedlings dying in the cotyledonary stage were produced from the cross of *M. alba* x *M. suaveolens*. The endosperm was slow in growth and the epicotyl and hypocotyl of the embryo failed to differentiate. Except for minor abnormalities at anaphase I and later stages, meiosis in $F_1$ *M. officinalis* x *M. alba* was normal. No meiotically abnormal individuals were found in the $F_2$. The autotetraploids of the two parental species and the allotetraploid had a similar mean and range of quadrivalent frequency at diacinesis and metaphase I. It is concluded that the structural differences between the chromosomes of these two species are therefore negligible. Meiosis in *M. messanensis* x *M. segetalis* showed a wide range of abnormalities, observations at pachytene providing evidence of heterozygosity for duplications, inversions and translocations. Bivalents at pachytene having terminal, subterminal and interstitial differential segments and reversed repeats within such segments were present in a large proportion of PMCs. Although *M. alba* and *M. officinalis* have structurally identical genomes, the hybrid between these species may only be obtained with the aid of embryo culture. *M. messanensis* and *M. segetalis*, on the other hand, have widely different genomes but are readily crossable. It is therefore concluded that interspecific incompatibility and genomic differentiation are two separate phenomena.

3991 Antjukov, N. V.
**(A new form of yellow sweet clover).**
Priroda (Nature), Leningrad 1959 : No. 3 : 115–16. [Russian].

A steppe ecotype of *Melilotus officinalis* f. *maculatus* found among the plants of the sweet clover variety Sladkij 20 [Sweet 20] in the province of Čeljabinsk has breeding value as it is characterized by good leafiness and low coumarin content.

3992 Skaare, S.
Forsøk med sølupin. (**Trials of sweet lupin**).
Forskn. Fors. Landbr. 1958 : **9** : 629–41.

In tests of five yellow and two blue lupins in Norway, the yellow varieties yielded more green matter than the blue but had a lower dry-matter content, so that yields of dry matter were similar.

3993 Rzegocińska, L.
Próby krzyżowania generatywnego różnych gatunków łubinu drogą szczepień wegetatywnych. (**Experiments on sexual crossing in different lupin species by means of vegetative grafting**).
Roczn. Nauk rol. : Ser. A. : 1957 : **77** : 103–11.

A shorter account of this work has already been abstracted from another source [XXVIII, 1783].

3994 A selecção de tremoços comuns (*Lupinus albus*) sem alcalóides. (**The breeding of *Lupinus albus* without alkaloids**).
Agricultura, Lisboa 1959 : No. 1 : 45–47.

A short account is given of the cooperative work being undertaken by the Max Planck Institut für Züchtungsforschung at Hamburg and the

Estação Agronómica Nacional of Portugal in the breeding of sweet lupins suitable for south European conditions by crossing north European sweet lupins with high-yielding bitter strains adapted to Mediterranean conditions.

3995 Hackbarth, J.
Betrachtungen über die Mosaikkrankheit der gelben Lupinen. (**Reflections on the mosaic disease of yellow lupins**).
Züchter 1959 : **29** : 59–63.

The present situation with regard to research on the above disease is surveyed. The causal organism appears to be a virus which is probably identical with *Phaseolus* virus 2. Certain differences in resistance to the virus have been observed among breeding lines and land varieties but wild forms of yellow lupin appeared to be particularly susceptible. Resistance is apparently under genetical control but the mode of inheritance is not yet known.

3996 Kempanna, C.
**Induction of fertility in genetically self-incompatible material of *Crotalaria juncea*.**
Mysore agric. J. 1958 : **33** : 133–35.

Fertilization did not occur following bud pollination, pollination after cutting of the stigma or pollination after washing the stigma with distilled water. Setting of fruits with viable seeds was observed after the stigma and ovary had been treated with 0·01% indole butyric acid but not after treatment with a 0·001% concentration of this chemical or with indole acetic acid. It is suggested that 0·01% indole butyric acid counteracts the effect of inhibitory factors in the style, which normally prevent self fertilization.

3997 Britten, E. J. & Laude, H. M.
**Control of flowering in *Indigofera endecaphylla* by photoperiod regulation.**
Trop. Agriculture, Trin. 1959 : **36** : 150–55.

At the Hawaii Agricultural Experiment Station, attempts are being made to produce a strain of *I. endecaphylla* free of toxin. In connexion with this breeding programme, experiments on the artificial control of flowering were conducted at Honolulu and Davis, California, with open pollinated seedlings of clone 137, a selection of an introduction from Puerto Rico. Flowering was found to be accelerated by short-day treatment. Also flowering depends on maturity for some mature plants eventually flowered in the absence of short days, whilst immature plants did not flower even when the photoperiod was favourable. Temperature did not appear to affect flowering.

3998 Łączyńska-Hulewiczowa, T.
Badania nad sztucznymi poliploidami. Część II. Seradela. (**Studies on artificial polyploids. II. Serradella**).
Roczn. Nauk rol. : Ser. A. : 1957 : **77** : 65–102.

A more detailed account of work reported elsewhere is presented [cf. XXVIII, 1790].

3999 Coutinho, L. de A.
Uma nova forragem. (**A new forage plant**).
Agricultura, Lisboa 1959 : No. 1 : p. 36.

An artificially induced tetraploid of *Ornithopus sativus* has proved superior to the parental diploid and other diploid strains in forage and seed production in trials in the Azores.

## ROOTS AND TUBERS

4000 Fruergaard, J. S.
Familieavlen i dansk rodfrugtforædling. (**Family selection in Danish root-crop breeding**).
Ugeskr. Landm. 1958 : **103** : 751–53.

Danish root-crop breeding since 1900 is briefly reviewed, reference being made to the family-selection method used chiefly up to 1930, the crossing methods used during 1930–50 and the development of heterosis and polyploid breeding since 1950.

4001 Egiazarjan, D. S.
**(The effect of supplementary pollination upon the formation of inheritance in hybrid beet progeny).**
Nauč. Trud. erevan. Univ. (Sci. Rep. Erevan Univ.) 1956 : **54** : 55–69; from Ref. Ž. (Ref. J.) 1958 : No. 9 : Abst. 38066 : p. 33. [Russian].

In experiments on multiparental pollination of sugar beet, mangel and beetroot, hybrids possessing the characteristics of two pollen parents were obtained.

4002 Stehlík, C.
Vliv vnitřních a vnějších příčin na morfologii bulvy řepné. (**The effect of internal and external causes on the morphology of the beet root**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinńa Výroba 1958 : **31** : 1321–56.

Descriptions are provided of root shape in *B. maritima, B. trigyna, B. lomatogena* and *B. patellaris* and in some crosses between (1) sugar

beet and (2) beetroot, *B. maritima* and *B. trigyna*. Investigations have been carried out on the relationship between root shape and chemical composition in hybrids between sugar beet and mangel or beetroot and the effects of selection on root shape.

4003 Fiedler, J.
Hodnota sazečkového semene československých odrůd krmných řep. (**The value of the seed of cuttings of Czechoslovak varieties of mangel**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinńa Výroba 1958 : **31** : 1457–66.

Seed derived from cuttings has been found useful in varietal tests of mangels. In tests held in different localities with several varieties it was found that the effect of the environment did not mask true varietal differences. Detailed information is provided on the performance of the varieties tested.

4004 Voederbieten, 1959. (**Mangels, 1959**).
Landbouwvoorlichting **16** : Bijl. 44; Ber. Rassenkeuze 1959 : No. 261 : Pp. 4.

Details of yields of fresh and dry matter, bolting resistance, ease of lifting and keeping quality are given for six sugar mangels, 17 mangels with high dry-matter contents and 45 with low, tested in the Netherlands in 1955–58. Several polyploids have shown promise.

4005 Zijp, M. J.
Resultaten officiële proefvelden voederbieten. CB-rassen in 1956 aan de spits. (**Results of official mangel trials. CB varieties leading in 1956**).
Meded. Nat. Coöp. Aan- Verkoopver. Landb. Cent. Bur. 1957 : **41** : No. 3 : 53–54.

Of 47 varieties tested in different areas in the Netherlands, Bison exceeded the average yield of dry matter by 6–8% and was the most resistant to bolting. Tabulated results are given for 26 varieties.

4006 Kloen, D. & Speckmann, G. J.
**The yielding capacity of tetraploid sugar and fodder beets.**
Euphytica, Wageningen 1959 : **8** : 29–36.

Tetraploidy was induced in two diploid sugar beets and five diploid mangels at the Wageningen Foundation for Agricultural Plant Breeding, Netherlands. Of a total of 793 $C_2$ families tested, 32% were better than the diploid varieties from which they were derived. It is recommended that strict selection for yield be avoided in early generations of tetraploid breeding, since a few generations are needed for the tetraploid material to become adapted.

4007 Schmidhauser, P. & Jucker, H.
Über die Haltbarkeit und Bekömmlichkeit (Beliebtheit) von Futterrüben. (**On the keeping capacity and palatability of mangels**).
Schweiz. landw. Mh. 1959 : **37** : 22–32.

Tabulated data are provided on the average yield and composition of mangels of four varieties tested at several centres in German-speaking Switzerland for three years. Oetofte gelbe [Øtofte Yellow] had a dry-matter content of about 18% and a sugar content of 12% whilst Zentaur [Centaur], Corona Original and Eckendorfer Ursus had a dry-matter content of about 12% and 7–8% sugar content. Oetofte gelbe gave the lowest yield of roots per unit area but the yield of dry matter per unit area was similar for all the varieties.

Details are also provided of the performance of these varieties at Katzensee, Regensdorf, in 1957. The resistance to pressure was determined for each variety; Oetofte gelbe was the most resistant. This variety also showed the best keeping capacity, being still healthy and fresh in the February following harvesting; the other three varieties were attacked by disease, the percentage of diseased roots varying between 10 and 40%. It was found that cows ate the mangels rich in dry matter less quickly than the mangels with less dry matter, these being generally softer. The consumption of dry matter per minute was greatest for varieties rich in dry matter.

4008 Stoppelknollen 1959. (**Turnips, 1959**).
Landbouwvoorlichting **16** : Bijl 50; Ber. Rassenkeuze 1959 : No. 267 : 1–6.

Data on the persistence of green colour in the leaves, resistance to night frosts and club root, the degree to which soil clings to the roots and the content and yield of dry matter in leaves and roots are given for 15 early to midlate varieties and 18 midlate to late varieties. Brief notes on each variety are included.

4009 Brykczyński, J. & Duś, A.
O pewnych regularnościach w występowaniu porusów ziarn pyłku. (**On certain regularities in the occurrence of pores in pollen grains**).
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 285–87.

In *Brassica rapa* var. *rapa* ($n = 10$), the number of pores per pollen grain is three for diploids and four for tetraploids. In *B. napus* var. *napobrassica* ($n = 18$), 64% out of a total of 75 diploids had three pores and 36% had four, while among 28 tetraploids, 64% had four, 35%

five and 1% six. Aneuploids (> 4*n*) of *B. napus* var. *napobrassica* had 3–5 pores.

4010 Rousseau, M.
Les navets "Waaslander" R.V.P. et "Meetjeslander" R.V.P. (**The turnips Waaslander RVP and Meetjeslander RVP**).
Rev. Agric., Brux. 1958 : **11** : 1672–74.
About 10 years ago the Waasland and Meetjesland turnips were found to be quite resistant to *Plasmodiophora brassicae*. The principal characteristics of these turnips are mentioned here. However they have now been severely attacked in localities in eastern Flanders; this indicates that a new physiological race of the pathogen has arisen. In Holland, they have remained resistant and a Dutch tetraploid variety has also shown high resistance there.

4011 Höppner, E.
Die Ertragsleistungen der Kartoffelsorten 1958. (**The yield performance of potato varieties 1958**).
Kartoffelbau 1959 : **10** : 48–49.
Information is provided on the yield of tubers and starch production of varieties grown commercially in Federal Germany.

4012 Kartoffelzucht im Bild. (**Potato breeding in pictures**).
Mitt. dtsch. LandwGes. 1959 : **74** : No. 4; Illustr. Beil. Pp. 8.
A brief pictorial account is presented of some of the work involved in breeding improved potato varieties.

4013 Feistritzer, W.
Ergebnisse der Kartoffelsortenversuche 1958. (**The results of the potato varietal trials, 1958**).
Kärntner Bauer 1959 : **109** : 172–73.
Tabulated information is provided on the yield of tubers and starch from 13 varieties tested at various centres in Carinthia; Fina gave the highest average yield of tubers and Maritta the highest yield of starch. Notes are provided on the chief characters of all the varieties.

4014 Roguski, K.
Wyniki drugiego etapu doświadczeń z letnim sadzeniem ziemniaków w IHAR w r. 1953/1954. (**Results of the second stage of experiments on summer planting of potatoes conducted by the Institute of Plant Breeding and Acclimatization in 1953-54**).
Roczn. Nauk rol. : Ser. A. : 1957 : **74** : 657–63.
Twelve varieties were studied at six localities in Poland, using a series of different planting times at each station. Varietal differences in yield and in incidence of virus diseases were smaller than those due to planting times. Lenino was the best variety, followed by Oka, Nowa Huta and Gromadzkie [Communal].

4015 Benvenuti, P.
Il miglioramento genetico della patata. (**Genetic improvement of the potato**).
Agricoltura, Roma 1959 : **8** : 25–36.
A review is given of the literature dealing with the tuberiferous species of *Solanum* and their floral biology, the various methods of improvement of the cultivated potato being outlined. It is stated that several further varieties are ready to take their place beside San Michele [cf. XXIII, 1287] among the potatoes bred in Italy.

4016 López Campos, G.
Labor de la Estación de Horticultura de Valencia en la selección de futuras variedades de patata, procedentes de la Estación de Mejora de la Patata. (**Work of the Horticultural Station of Valencia in selecting future potato varieties originating from the Potato Breeding Station**).
Aspas, Madr. 1959 : No. 30 : 3–6.
In the combined breeding programme of the Potato Breeding Station at Vitoria, which has a single crop per year, and the Horticultural Station at Valencia, where two potato crops per year are harvested, the first two multiplications from seed are carried out at Vitoria, while in the third and subsequent years the clones are screened in both seasons at Valencia and also in the single season at Vitoria, a total of eleven multiplications in five years being undergone by selected clones prior to testing in varietal trials. The advantages of the procedure are not only the saving in time and space but also the greater variety of conditions under which selection may be effected.

4017 Bukasov, S. M., Kameraz, A. Y. [Ja.] & Tsunoda, K. (Translator).
(**Potato breeding**).
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 307–10, 433–36, 567–70. [Japanese].
An abridged translation is given of work previously reported [cf. XXVI, p. 328].

4018 Vigerust, Y.
Forsøk med poteter på Ny Jords Forsøksgard Moldstad, 1941–56. (**Experiments with potatoes at the Ny Jord Experiment Station, Moldstad, 1941-56**).
Forskn. Fors. Landbr. 1958 : **9** : 659–78.
In the varietal trials forming part of this series

of experiments on newly cultivated bogland on the island of Smøla, Norway, Up to Date gave the highest yields of the 12 varieties tested and also exceeded the standard, Kerr's Pink, in yields of large tubers and of dry matter.

4019 Aardappels, 1959 (observatieproefvelden). [**Potatoes, 1959 (observation trial fields)**].
Landbouwvoorlichting **16** : Bijl. 48; Ber. Rassenkeuze 1959 : No. 265 : Pp. 4.
Data on earliness, tuber yield and content and yield of dry matter are given for 42 varieties tested on different soil types in the Netherlands. Descriptive notes on the 23 new varieties taking part in the trials are included.

4020 Aardappels, 1959 (interprovinciale proefvelden). [**Potatoes, 1959 (interprovincial trial fields)**].
Landbouwvoorlichting **16** : Bijl. 49; Ber. Rassenkeuze 1959 : No. 266 : Pp. 7.
Tabular data and notes on the performance of table, industrial and export potatoes tested in the Netherlands on different soil types are presented.

4021 Ivančenko, G. Z.
**(At the Moscow Experimental Breeding Station).**
Kartofel' (Potato), Moskva 1958 : No. 6 : 52–53. [Russian].
Potato breeding at the above institute is discussed and the recent varieties Vel'jaminovskij, a selection of Aquila, Ljubimec [Favourite] and Jaroslavl' are described. All three are resistant to *Phytophthora* and degeneration and the first two also to wart. In addition to these, mention is made of interspecific hybrids bred for high starch content or *Phytophthora* resistance. Among the former are hybrids of *Solanum curtilobum* and of *S. leptostigma* having a 3–6% higher starch content than Wohltmann. *Phytophthora*-resistant material has been derived from later generations of *S. demissum* hybrids. The breeding techniques included vegetative rapprochement, which has been employed successfully for (1) improving the pollen fertility of Lorh, Rannjaja Roza [Early Rose], Ostbote and Wohltmann, (2) improving crossability between domestic varieties and *S. demissum*, and (3) shortening the stolons in hybrids of *S. curtilobum* or *S. leptostigma*. Oktjabrenok [Little Octobrist], Carnea and K1711 were among the varieties which were used as graft components for shortening stolons.

4022 Wilhelm Hofferbert 60 Jahre alt. (**Wilhelm Hofferbert 60 years old**).
Mitt. dtsch. LandwGes. 1959 : **74** : p. 470; and Kartoffelbau 1959 : **10** : 112–13.
A brief account is presented of the work of this potato breeder who has been concerned in the breeding of some valuable German varieties.

4023 Lipińska, J.
Rola pośredników w krzyżówkach międzygatunkowych ziemniaka. (**The role of intermediaries in interspecific crosses of potatoes**).
Roczn. Nauk rol. : Ser. A. : 1957 : **74** : 571–81.
Reciprocal crosses of *Solanum tuberosum* with *S. demissum, S. chacoense, S. commersonii, S. acaule, S. polyadenium, S. caldasii, S. antipoviczii, S. kesselbrenneri, S. phureja, S. jamesii* and others gave seeds with only 1% viability, but by means of reciprocal crosses of *S. tuberosum* with intermediaries from crosses of the wild species *inter se* the germination percentage was increased to 4–10% and occasionally reached 26%.

4024 Kawakami, K. & Matsubayashi, M.
**Studies on the species differentiation in the section *Tuberarium* of *Solanum*. II. Meiotic behaviour in the triploid $F_1$ hybrid from *S. longipedicellatum* x *S. chacoense*, with some regards to chromosome affinity between the parent species.**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1956 : **2** : 143–48.
A configuration of $12_{II} + 12_I$ was observed in $F_1$ *S. longipedicellatum* ($2n = 48$) x *S. chacoense* ($2n = 24$), with the exception of a few trivalents in some PMCs [cf. XXVI, 2562]. Various irregularities were observed at anaphase I and subsequent stages of meiosis. The hybrid was almost completely sterile. It was provisionally concluded that pairing was largely allosyndetic, the two species having in common a highly homologous set of 12 chromosomes.

4025 Kawakami, K. & Matsubayashi, M.
**Studies on the species differentiation in the section Tuberarium of Solanum. V. Genomic affinity between *Solanum verrucosum* and *S. demissum*.**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1957 : **3** : 17–21.
Pairing at metaphase I in two $F_1$ hybrid plants

($2n = 48$) of *S. verrucosum* ($2n = 24$) x *S. demissum* ($2n = 72$) reached a maximum of $24_{II}$ or $22_{II} + 1_{IV}$. Subsequent stages of meiosis were almost completely regular, one plant having 63·1% stainable pollen and the other 67·0%. The results suggested that the genome of *S. verrucosum* is almost entirely homologous with one of the genomes of *S. demissum*. The genome constitution $D_1D_1D_2D_2VV$ is proposed for the latter species.

4026 **A new Scottish potato variety.**
Scot. Agric. 1959 : **39** : p. 57.

Pentland Crown, bred at the Plant Breeding Station, Pentlandfield, Roslin, is an early maincrop variety immune from wart disease. It also shows fairly high resistance to virus Y and moderate resistance to dry rot and to gangrene but is susceptible to skin spot. The cropping of this variety is very good and cooking and keeping quality are also good. The oval slightly flat tubers have white flesh and a white skin which turns mainly green on exposure to light.

4027 Nouvelles variétés inscrites au Catalogue français en 1958. (**New varieties registered in the French catalogue in 1958**).
Pomme d. Terre franç. 1959 : **22** : No. 236 : 12–15.

Diplomate [Diplomat], originating from a cross between Bintje and Alpha, is a semiearly culinary potato of good yield and resistant to wart but the foliage is susceptible to late blight. The tubers are large, the skin and flesh yellow and the eyes are superficial. Fecula (Falke x Hochprozentige [High Percentage]) is a late variety resistant to wart and fairly resistant to late blight. It has a very high starch content and gives a good yield. Flaminia (Vale x D–10–37) is a midearly culinary variety which gives a good yield of average-sized tubers with yellow flesh and red skin. It is resistant to wart but the foliage is susceptible to late blight. Kenta, originating from the cross Primula x 834(c)29, is also a culinary variety and gives particularly high yields; it is semiearly and resistant to wart, the foliage being fairly resistant to late blight. The skin is smooth and yellow, the flesh is of a light yellow colour and the eyes are superficial. Mador, from the cross Fausse Marjolin [False Marjolin] x BF15, is a high-yielding variety of average earliness, resistant to wart and fairly susceptible to late blight; it has yellow flesh and skin and shallow eyes. Stella (Kerpondy x Hyva) is of good eating quality and gives a fairly good yield; it is semiearly, resistant to wart, susceptible to late blight and shows average resistance to scab. Wigro, from a cross of Alpha x Katahdin, is also semiearly and gives a good yield of large yellow tubers. It is resistant to wart and the foliage is susceptible to late blight.

4028 **(Selection in production).**
Kartofel' (Potato), Moskva 1958 : No. 6 : p. 60. [Russian].

This article gives information on increases or reductions in the areas under some potato varieties and criticizes the slow introduction of Vel'jaminovskij, Volžanin [potato from the Volga], Vyrapaev, Družba [Friendship], Muravlevka (= Belaja Majka [White May]), Pobeda [Victory], Severjanin [Northerner], Sedov, Jugo-Vostočnyj [South-eastern] and Južanin, all of which are referred to as "new valuable varieties".

4029 Pays-Bas. Nouvelles variétés de pommes de terre. (**Holland. New potato varieties**).
Pomme d. Terre franç. 1959 : **22** : No. 236 : p. 15.

Brief notes are provided on five varieties added to the Dutch catalogue in 1958.

4030 **Scab-resistant potato developed.**
Colo. Univ. News 1959 : **13** : No. 9; Colo. Fm. Home Res. 1959 : **9** : No. 4 : p. 12.

The new potato Navajo, developed at the Agricultural Experiment Station of Colorado State University and with good yield and quality, has shown scab resistance in most areas in Colorado and field resistance to late blight.

4031 Balašev, L. L. & Mohov, V. A. (**The growing conditions of the potato in central Kazahstan**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 7 : 133–38. [Russian].

Various agronomic measures intended to control the different forms of degeneration of the potato in the hot, dry climate of Kazahstan are discussed and descriptions of four hybrids bred at the Karaganda Agricultural Research Station are given. Rekord [Record], from Epicure x [*S. andigenum* x Smyslovskij (= Fürstenkrone)], and 580, also a hybrid of *Solanum andigenum*, are midseason types resistant to diseases and with tubers having a good flavour. Rekord yields well, is rich in starch and keeps well. Dolinka, from *S. tuberosum* var. *roseum* x (Centifolia x *S. andigenum*), produces large red tubers and matures later than the above-mentioned varieties. Karaganda, from Epicure x (Centifolia x *S. andigenum*), is characterized by earliness and high yield.

4032 Mallett, J. B.
**New potato variety shows promise in Natal.**
Fmg. in S. Afr. 1959 : **35** : No. 2 : 52–54.
BP1 has not only outyielded Up-to-Date but has shown less susceptibility to late blight and other diseases [cf. XXVIII, 4390].

4033 Aņikijevs, A.
Agrā augstražīgā kartupeļu šķirne. (**An early high-yielding potato variety**).
Augsne un Raža, Rīgā 1958 : **7** : 259–62.
Carnikavas (Kungla x Oktjabrenok [Little Octobrist]) was bred at the Latvian Agricultural Research Institute. It outyields the Latvian standard Priekuļu agrie [Priekuļi Early] by 28% and exceeds it in starch content. It keeps well, is resistant to *Synchytrium*, moderately resistant to *Phytophthora* and *Alternaria* and has tubers of good table quality.

4034 Kotov, A. F.
(**Clonal selection of the potato in summer sowings**).
Agrobiologija (Agrobiology) 1958 : No. 5 : 86–89. [Russian].
Kur'er Odesskij Uluchšennyj [Improved Odessa Courier] was selected for long growth period from Kur'er, sown in summer at Odessa. It outyields the parent variety both in spring and summer sowings, is more vigorous and shows improved resistance to frost and *Alternaria*.

4035 Brücher, H.
Beiträge zur Abstammung der Kulturkartoffel. (**Contributions to the origin of the cultivated potato**).
SB dtsch. Akad. LandwWiss. Berl. 1958 : **7** : No. 8 : Pp. 44.
In view of the large number of tuber-bearing species of potato found in South and Central America, it is suggested that this group be given the generic name *Tuberarium* as previously proposed by Bitter.
Hypotheses regarding the origin of cultivated potatoes are critically reviewed in some detail. It is thought that cultivated *S. andigenum* forms arose as autopolyploids from the diploid *S. vernei* [cf. XXV, 1179].

4036 Palazuelos, A. S.
Estudios citogenéticos en el gén. *Solanum*, series *Cardiophylla* y *Pinnatisecta*. (**Cytogenetical studies in the genus *Solanum*, series *Cardiophylla* and *Pinnatisecta***).
Bol. Inst. Invest. agron., Madr. 1958 : **18** : 371–81.
Meiosis was studied in three strains of *S. ehrembergii*, two of *S. lanciforme*, three of *S. cardiophyllum*, two of *S. sambucinum*, three of *S. pinnatisectum* and two of *S. jamesii*. Univalents and laggards were present in all species, with a maximum average value of 4·12 per cell in *S. pinnatisectum* (E–32). No aberrant chromosome numbers were found among plants in the progenies, suggesting that only gametes with the normal chromosome number were viable. Lagging bivalents were observed occasionally in *S. ehrembergii*, *S. lanciforme* and *S. sambucinum*. Arrested terminalizations indicating lack of homology were frequent, and bridges, fragmentation and asymmetric bivalents also occurred. Stickiness was observed in chromosomes of *S. lanciforme* and *S. sambucinum* and appeared to be heritable, segregating in the $F_1$; the determinant factor is designated *sticky*. The above anomalies, together with the low chiasma frequency and the high coefficient of terminalization, are regarded as evidence that differentiation in *Solanum* has been accompanied by pronounced structural changes in the chromosomes.
Pollen sterility, which varied according to external conditions, occurred in all species, the highest value of about 50% being found in *S. pinnatisectum* (E–35) and *S. sambucinum* (E–52) and the lowest of 10–15% in *S. ehrembergii* and *S. lanciforme*. In a number of cases there appeared to be some correlation between fertility and frequency of chromosomal aberrations.

4037 Lebedeva, N. A.
(**A comparative study of the diploids and tetraploids of *Solanum verrucosum* Schlechtd.**).
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1959 : **125** : 194–96. [Russian].
Morphological, physiological and biochemical differences observed between the above 24-chromosome species and its colchicine-induced tetraploid at the Institute of Plant Industry are described. The tetraploids were more vigorous and produced double the amount of tubers, these being also larger. The fertility of the tetraploids was inferior. Seven berries resulted from self pollination on two out of 22 tetraploid plants and the berries contained 27 to 73 seeds, as against 150–200 in the diploids. The fertility of the tetraploids improved in the first sexual and first tuber generations, most plants developing berries after self pollination. Three polyploids bore as many berries as the diploids, the berries containing 50–114 seeds. The polyploids

equalled the initial form in resistance to *Phytophthora.*

4038 Joseph, E., Münster, J. & Mayor, G.
Contribution à l'étude de la tuberisation chez la pomme de terre. (**A contribution to the study of the development of tubers in the potato**).
Europ. Potato J. 1959 : **2** : No. 1 : 1–21.

At Cery, Lausanne, studies were made during 1956 and 1957 of eight varieties growing in a split-plot layout. Pregermination had occurred, the percentage of germinated eyes being determined before planting. At five successive dates during the growing period, observations were made on the stage of development of 30 plants of each variety; the number of main and side shoots and of newly formed and further developed tubers and the yield in three size grades were determined. Weather conditions and the method of pregermination were found markedly to affect development.

Little difference was found between varieties in respect of the total number of eyes per tuber but the number of eyes which germinated and the number of main shoots per plant were typical of the variety and unrelated to maturity period.

The potatoes studied appeared to be of three main types. The first, exemplified by Sirtema, is an early type with relatively few large tubers and a high daily increment in yield; in order to produce a large number of seed potatoes, the pregermination period must be short. The second type, represented by Bintje, also has a high daily increment in yield and produces a fairly large number of tubers per plant. An early high yield of tubers of a size suitable for seed is produced as a result of a pregermination period of 3–4 weeks. The third type, e.g. Ackersegen, produces a large number of tubers per plant and these develop late; it is often difficult to obtain a satisfactory yield of seed potatoes early in the season.

4039 Zubeldia, A.
Los "bolters" y la selección. (**Bolters and selection**).
ASPAS, Madr. 1958 : No. 29 : 2–4.

After brief notes on the wilding and feathery-wilding types of mutant, descriptions of bolter types occurring in different varieties grown at the Vitoria Potato Breeding Station in Spain are given. Flowering more abundantly, ripening later and producing coarser tubers than the mother variety, they are regarded as mutational adaptations to short-day conditions.

4040 Lipińska, J.
Krzyżowanie generatywne w hodowli ziemniaka. (**Sexual crossing in potato breeding**).
Roczn. Nauk rol. Ser. A. : 1957 : **76** : 573–78.

After a general survey of methods of artificial crossing the following observations are noted. Pollen germination on agar begins after 12 hr. in cultivated potatoes and after 24 hr. in wild species. Pollen which proved fertile on agar was not always effective in fertilization; this is ascribed to physiological incompatibility. Fertilization by the varieties Błękit [Blue] and Epoka [Epoch] ranged from 2–3% to 20–30%. Unikat, Delfin, R1139, Katahdin, Merkur and Tiger appeared to be good pollinators, while Alma, Edelgard, Robusta, Stärkeragis, Imandra, Unikat, Wista, Grünwald and Delta proved to be good mother plants. High temperatures and low humidity lower the rate of successful pollination.

4041 Šitov, V. V.
(**Techniques for crossing potatoes**).
Agrobiologija (Agrobiology) 1958 : No. 4 : 129–30. [Russian].

Methods for collecting and storing potato pollen developed at the Kurgan Agricultural Research Station, together with experiments on intervarietal hybridization with pollen kept for 2, 14 or 24 days, are described. A table shows the numbers of berries formed on Majestic and Lorh, with Centifolia or Kinel'skij Bogatyr' [Kinel' Hero] as the pollen parents. The highest number of berries, 59, was obtained from Lorh plants fertilized by Kinel'skij Bogatyr' pollen kept for 14 days and the fewest, 2, from Majestic pollinated with Centifolia pollen kept for 2 days. No berries were formed by Lorh fertilized by the pollen of Centifolia kept for 24 days.

4042 Magoon, M. L., Hougas, R. W. & Cooper, D. C.
**Cytogenetical studies of complex hybrids in Solanum.**
J. Hered. 1958 : **49** : 285–93.

A theoretically possible method of transferring desirable characters from *S. demissum* to the common potato is to cross the former with a diploid species and then hybridize the resulting tetraploids with *S. tuberosum.* Synthetic tetraploids, derived from $6n \times 2n$ matings, were always used as female parents with *S. tuberosum* var. Katahdin as the male parents. The course of microsporogenesis in these triple hybrids is described. Meiosis seemed to be irregular, with abnormalities including multivalents, univalents, lagging and elimination of chromosomes,

chromatin bridges and fragments, occurring at various stages. These result in a loss of genetic material, and lead to poor pollen and seed production and variability of chromosome number in the progeny. The seed set was very low when the hybrids were crossed with a *S. tuberosum* male, though a good amount of seed was obtained when many of the meiotically irregular *S. tuberosum* selections were pollinated with a fertile *S. tuberosum* male. Thus, contrary to the theoretical expectation, these tetraploid hybrids do not have the expected regularity of meiosis and may not be suitable for large-scale utilization in breeding.

4043 Hawkes, J. G.
**Significance of wild species and primitive forms for potato breeding.**
Euphytica, Wageningen 1958 : **7** : 257–70.

After a brief historical survey of the use of wild and primitive forms in breeding, fertility relationships and resistance to pests and diseases are considered. The tuber-bearing species fall into five intersterile but intrafertile groups, of which the largest includes the series *Tuberosa*; three groups contain only one species each. Among the diploids, comprising about 70% of all potato species, self fertility is found in only three of the tuber-bearing group. Tetraploids and hexaploids, respectively comprising about 15 and 8% of the total, are generally self fertile. Chromosome pairing is very regular in the hexaploids and it is thought that breeding at this level of polyploidy may be possible.
With the exception of resistance to viruses X, A, B and C, which seems to occur sporadically throughout South America and Mexico, resistance to a particular disease appears to be confined to one or occasionally two geographical areas. Genes conferring resistance to *Phytophthora infestans*, virus Y and Colorado beetle are found in Mexico; in Argentina and neighbouring countries, genes for resistance to virus Y, virus X, leaf roll, Colorado beetle and eelworm occur. Usually a large number of species within a certain area possess resistance to any one disease; if the disease is indigenous to the area, such resistance is likely to be the result of natural selection. Resistance to Colorado beetle is often associated with resistance to other insects, and since the areas for Colorado beetle resistance coincide with those for virus Y resistance, it is suggested that protection against insect-transmitted viruses may be afforded both by genes rendering the plant unpalatable to insects and by those conferring direct resistance.

4044 Hölzl, J. & Bancher, E.
Über Vorkommen und Sortenabhängigkeit der Eiweisskristalle in der Kartoffelknolle. (**The occurrence and varietal incidence of protein crystals in the potato tuber**).
Bodenkultur 1959 : **10** : 110–15.

The cubic protein crystals found in the peripheral tissues of potato tubers were found to have nothing to do with virus infection; instead they form a protein reserve. Amongst the 15 varieties of potato investigated, marked differences were found in the frequency and size of the crystals and in the thickness of the tissues containing the crystals.

4045 Zadina, J.
Velikost škrobových zrn u bramborů. (**The size of the starch grains in potato**).
Věd. Práce výzk. Ústav. Brambor. Havlíčkově Brodě 1958 : 125–42.

In a study of a large collection of Czechoslovak and foreign varieties of potato, a correlation coefficient of + 0·32 was found between the size of the starch grains and the starch content. Also it was found that, on the whole, varieties with a longer vegetative period had larger grains.

4046 Oniščenko, A. I.
(**The root systems of different varieties and hybrids**).
Kartofel' (Potato), Moskva 1958 : No. 6 : 45–47. [Russian].

Tabulated evidence is presented showing that the interspecific potato hybrids Rannjaja Roza [Early Rose] x *Solanum boyacense*, Rannjaja Roza x *S. caniarense*, Earlaine x *S. boyacense*, *S. boyacense* x Earlaine, and Witch Hill x *S. kesselbrenneri* had better developed root systems than the corresponding cultivated parent. Parallel experiments with healthy and degenerate plants of Lesostepka [Woody Steppe] showed that the former, while more vigorous and productive, had less well-developed root systems.

4047 Maierhofer, E.
Untersuchungen und Erfahrungen über die Pfropfung der Kartoffelsorte "Bintje" auf Tomatenunterlage zur Förderung der Blütenbildung. (**Investigations and experiences of grafting the potato variety Bintje on tomato rootstocks for promoting flower formation**).
Bodenkultur 1959 : **10** : 116–21.

On account of its photoperiodic requirements, Bintje produces hardly any flowers in central

Europe. This variety has now been induced to flower at Kefermarkt, Austria, by grafting on to tomato rootstocks. From 75 grafted plants, 843 berries with 10,008 seeds were obtained from crosses with Juligold. The earliest flowers of the mother plant were less fertile than the later ones but the stage of development of the seed parent at the time of hybridization had no effect on the germinating capacity of the resulting seeds.

4048 Höppner, E.
Die Ertragsleistungen der stärkereichen Sorten. (**The yield performances of varieties rich in starch**).
Kartoffelbau 1959 : **10** : 2–4.

Data are provided on the starch production of seven industrial varieties of potato and of three others which are suitable for both industrial and culinary purposes. The late varieties Herkula, Susanna, Capella and Fabricia gave the best yields of starch per unit area; Erdkraft had the highest starch content.

4049 Hacke, F. & Schröder
Maschinelles Schälen von Kartoffeln. (**Mechanical peeling of potatoes**).
Kartoffelbau 1959 : **10** : 78–84.

Potatoes from six varieties grown under similar conditions were used in a peeling trial and clear differences were observed between varieties in respect of suitability for mechanical peeling. In autumn the percentage of waste varied between 23·6 for Bona and 31·2 for Maritta and the time for cleaning ranged between 2·12 min./kg. for Lori and 3·85 min./kg. for Maritta. The waste percentage and cleaning time were in all cases greater in the spring when the tubers were less firm. As regards the cost of peeling, this was lowest in Carmen in autumn and in Bona in spring. It is thought to be important that breeders should pay attention to improving varieties in respect of their suitability for mechanical peeling.

4050 Kopal, S.
Světový sortiment bramborů podle složení. (**The world potato collection in respect of composition**).
Věd. Práce výzk. Ústav. Brambor. Havlíčkově Brodě 1958 : 143–91.

The results are reported of chemical analyses of 398 varieties, including potatoes originating from 13 different countries and others of unknown origin; information is provided on the chemical components of importance both for household and industrial purposes.

4051 (**Material for breeding tuber crops with a high starch content**).
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : p. 154. [Japanese].

Brief reference is made to Japanese work using wild *Solanum* species, in particular *S. demissum*, for crossing with *S. tuberosum* to produce varieties with an improved starch content. Mention is also made of variation in starch content due to location and season. [Cf. 1724].

4052 Lugt, C.
Een selectiemethode op gevoeligheid voor bruinkleuring van pommes-frites. (**A selection method for susceptibility to browning of potato chips**).
Jaarboek 1958. Med. Inst. biol. scheikund. Onderz. LandbGewass., Wageningen 1958 : No. 53 : 87–98.

A correlation coefficient of + 0·76 was obtained between the colour of potato chips fried in the normal way and the colour of drops of tuber sap placed on filter paper and fried for two minutes at 180° C. after removal of the starch. The samples used were 100 progenies from Bintje x Oberarnbacher Frühe [Oberarnbach Early] and a sample of Bintje as standard. A golden yellow colour is required, appearance, crispness and flavour all being spoiled by browning, which is dependent partly on variety and partly on storage temperature, sprouting, lack of potassium and infection with blight.

4053 Perlova, R. L.
(**The behaviour of wild and cultivated species of potato in different geographical regions of the Soviet Union**).
Akad. Nauk SSSR, Glavn. Bot. Sad, Moskva 1958 : Pp. 238. [Russian].

The potato collection of the Institute of Plant Industry, Leningrad, was grown in 1932 and succeeding years near Leningrad and in later years also in the Pamir, the North Caucasus, the Moscow region and Siberia. The present volume embodies the results of the observations made on the species in these various localities by the author and her colleagues.

An outline is given of information on the geographical distribution of the main species of *Solanum* in South and Central America, their physiological characteristics, the diseases and pests to which they are resistant and the other qualities that make them valuable as parents in breeding.

The polyphyletic origin of *S. andigenum* assumed

by Bukasov and by Hawkes is thought to be improbable and *S. herrerae* is suggested as the most likely species to have given rise to *S. andigenum* in the mountain areas of Peru. The wild ancestors of *S. tuberosum* in Chile are considered to be *S. leptostigma* and *S. molinae*. The influence that cultivation in different places can have is illustrated by the variety Early Rose, which in Russia today differs markedly from the original Early Rose introduced from the USA and is moreover represented by a series of different types according to the area in which it is grown.

A detailed account is given of the behaviour of the wild species when grown near Leningrad, tabular data being given on chromosome number, disease, drought and frost resistance, fruit and tuber formation, number and size of stomata, depth of roots and transpiration rate. The species most adapted ecologically to the Leningrad area in a series of abnormally dry years were *S. commersonii*, *S. vallis-mexici* and *S. jamesii*, all from arid districts and all characterized by a high transpiration rate and well developed root systems. No correlation was found between drought resistance and size of stomata. The species differed in period of dormancy and time of flowering, those from high altitudes tending to flower early. Certain species form tubers at Leningrad in the open but others form them only with artificially reduced photoperiod, though some species give very few tubers even under these conditions.

Similar data are presented for the primitive cultivated species of the Andes. The best adapted of these was *S. rybinii*, which has the lowest number and size of stomata of all; this species proved quite drought resistant. Almost all the species in this group were late in flowering and low in fertility. *S. rybinii* gave the highest yield of tubers in long days. Neither in this group nor in the wild species was any clear correlation found between photoperiodic reaction and the latitude from which the species came.

Data for *S. andigenum* are presented separately. Forms such as f. *chiar-imilla* with deep root systems proved best adapted to Leningrad conditions, though this particular form had a relatively low transpiration rate. Most forms of *S. andigenum* are distinguished by high fertility; some form tubers in long days just as well as in short, these being mostly the forms collected in areas of higher latitudes.

Domestic varieties of *S. tuberosum* developed more vigorous root systems than any of the wild or primitive species, late varieties having deeper roots than early ones; in general the varieties with the best developed root system had the highest transpiration rate.

In western Pamir at an altitude of 2320 m. the majority of the species, both wild and cultivated, and their hybrids flowered more profusely and all species formed berries, with the exception of the wild species *S. coyoacanum*, *S. cardiophyllum*, *S. bulbocastanum* and *S. vavilovii* and the primitive cultivated species *S. juzepczukii*. *S. andigenum* and *S. tuberosum* flowered later than the primitive and, particularly, than the wild species. In *S. andigenum* the forms from southern Peru, Bolivia and Chile flowered earlier than those from more equatorial regions. Differences between the species were noted in the time at which the flowers opened and closed. The greater fertility of the species and hybrids in the Pamir made it possible to make a number of interspecific crosses that had not previously been successful and to get $F_2$–$F_3$ progenies from hybrids that had previously been found sterile. The majority of the species had 80–90% pollen fertility, only the triploids *S. millanii*, *S. maglia* and *S. vallis-mexici* having a fertility not exceeding 25–30%; the triploid species produced little or no seed in the berries whereas those of most other species had plenty of seed; exceptions however were *S. vavilovii*, *S. cardiophyllum* and *S. jamesii* in the wild species and *S. kesselbrenneri* and *S. cuencanum* in the cultivated; the first three species failed to form seed when pollinated with highly fertile species and seem to be female sterile.

All species when grown in western Pamir proved more frost resistant, which was apparently associated with their greater sugar content. Tuber production was also better in western Pamir than in other places in the Soviet Union in most species; the equatorial forms of *S. andigenum* gave better tuber yields than those from Peru and Bolivia. *S. tuberosum* forms from Chile and Europe gave low tuber yields in the first few years but later became well adapted. Data are given on some of the hybrids that have shown good combinations of tuber yield and fertility. Yields of 700 and 750 g. per plant were obtained from early-maturing hybrids of *S. phureja* x *S. rybinii* and *S. rybinii* x *S. caniarense* respectively. Several hybrids from crosses with triploid species gave relatively good yields, the best being *S. chocclo* x *S. macmillanii* with up to 1610 g. per plant and *S. chocclo* x Betula with 1130 g. Various hybrids of wild species with domestic varieties also gave good yields, among the best being *S. vallis-mexici* var. *polyploideum* x Stärkeragis with up to 1720 g. per plant; hybrids with large tubers weighing up to 450 g.

were obtained from *S. maglia* x Centifolia. Hybrids of *S. acaule* grafted on Early Rose, crossed with Smyslovskij (= Fürstenkrone) yielded up to 850 g. The hybrids of domestic varieties with primitive cultivated varieties all gave good yields of seed and tubers, the best being those from *S. boyacense* and *S. rybinii*; thus Brita x *S. boyacense* yielded up to 2100 g. of tubers per plant, Alma x *S. boyacense* 2020 g. and Epicure x *S. rybinii* 1650 g. Hybrids of *S. antipoviczii* with domestic varieties were only slightly inferior to the foregoing, many having a mean tuber yield in 1935–37 of over 1000 g. per plant. Good yields were obtained also from crosses of domestic varieties with *S. leptostigma* and *S. molinae*, some of which gave mean yields of up to 1895 g. per plant. Hybrids of *S. curtilobum* with domestic varieties were not particularly high in yield. Some forms of *S. andigenum*, particularly those from Colombia and Bolivia, gave very good yields in crosses with domestic varieties, the best exceeding 2000 g. in mean yield per plant. Back-cross hybrids from *S. demissum* gave mean yields varying from 1000 to 2300 g. per plant and some of the complex hybrids comprising three or more species also yielded well, a yield of 2970 g. per plant being obtained from ($F_3$ *S. demissum* x *S. andigenum* var. *bolivianum*) x Pepo. Many of the hybrids had large tubers, those from Lorh or Korenevskij x *S. andigenum* f. *tocanum* weighing from 900 to 2200 g.

Most species and hybrids had a lower starch content than when grown in Moscow or Leningrad, vitamin C content seemed to be higher, degeneration was less marked, and the osmotic pressure of the roots was greater, especially in the cultivated species.

The seed progeny of many of the diploid and tetraploid species produced in western Pamir showed segregation for flower colour and other features. The triploid species *S. vallis-mexici*, completely sterile in Leningrad, produced berries, most of which were devoid of seeds but a few seeds produced from selfing gave rise to progeny that bred true to the maternal type but had doubled in chromosome number ($2n$ = 70–73) and bore larger berries with higher seed content. The seedlings when pollinated with the variety Stärkeragis gave a 22·4% set and the seeds gave rise to hexaploid seedlings ($2n$ = 60); these also crossed quite well with domestic varieties, were quite fertile on selfing and gave good sets when used to pollinate *S. commersonii*, *S. maglia*, *S. pamiricum*, *S. ciecae* and the variety Edelgard. A pentaploid hybrid of *S. vallis-mexici* ($2n$ = 73) x Stärkeragis provided material from which the new variety Puškinskij was bred. This hybrid was much more vigorous than a hybrid from *S. vallis-mexici* ($2n$ = 36) x *S. tuberosum*, which was also pentaploid and evidently arose from an unreduced egg cell of *S. vallis-mexici*. The hexaploid seedlings of *S. vallis-mexici* showed no resemblance to *S. demissum* or any other of the hexaploid species. The triploid *S. maglia* also bore fruits in western Pamir, most of them containing 5–16 seeds, from which mostly diploid or aneuploid seedlings ($n$ = 24 + 1–2) were obtained. They resembled the mother plant in most features but were smaller. They are thought to have arisen by parthenogenesis and are highly fertile, the berries containing up to 92 seeds; they also produce a larger number of tubers. They have been named *S. pamiricum*, which is thought to be close to the original diploid species from which *S. maglia* must have arisen by autotriploidy.

The triploid cultivated species *S. tenuifilamentum*, *S. mamilliferum* and *S. cuencanum* all formed berries and the seeds in all three cases gave rise to tetraploid seedlings ($2n$ = 48–50) with a high degree of fertility on selfing and crossing with other species. Segregation occurred for a number of characters; none of the segregates had any resemblance to any known diploid species but showed greater similarities to *S. andigenum*, which is therefore considered to be one of the progenitors of the species in question.

The tetraploid *S. molinae* formed berries and seeds abundantly, giving rise to seedlings displaying certain morphological differences from the parent, some of them having entire leaves, but no changes in chromosome number occurred.

At an altitude of 3500 m. many of the species from high-lying localities and their hybrids also formed tubers, berries and seeds freely and some of them withstood temperatures of − 7 to − 8° C.

Trials of a number of domestic potatoes showed Centifolia to be the best adapted to the ecological conditions of the Pamir.

In the North Caucasus almost all the wild species except the triploids formed good pollen and even the triploids, *S. commersonii*, *S. maglia* and *S. vallis-mexici*, formed a certain amount; the actual quantity varied in different localities. At Šestak, at 500 m. altitude, *S. commersonii* formed berries with a certain number of well developed seeds, which it had failed to do in western Pamir, where the humidity and temperature were both lower. Tuber formation was also good at Šestak and certain other places. Grown in Moscow, the wild species behaved

differently in different years; in 1948, a year with a hot summer with high humidity, most of the wild species flowered and fruited, the only exceptions being *S. aracc-papa* and *S. jamesii*; in other years many species failed to fruit, the only ones that bore fruit every year being *S. schickii, S. horovitzii* and *S. dolichostigma*. Tuber formation in the open was better than in Leningrad; though most species formed more tubers under short days, photoperiod is clearly not the only factor that influences tuber formation. The cultivated species failed to produce fruit in some years, in one year only *S. goniocalyx* fruited and in others certain forms of *S. andigenum* and *S. tuberosum* also bore fruit. In some years most of the species formed tubers, the best yields being in the early-maturing species *S. chaucha* and *S. caniarense* and the Chilean forms of *S. tuberosum*. In all cases the tuber yields were higher than in Leningrad.

The seed progeny of many of the wild species segregated in dormancy period; some of the seedlings from *S. laplaticum* sprouted in 10–12 days compared with 14 days in the parent. Seedlings that sprouted earlier than the parent were obtained also from *S. horovitzii*, whereas *S. dolichostigma* gave no segregation. Segregation also occurred in some species for length and number of stolons; seedlings with relatively short stolons, 5–15 cm. in length, occurred in progenies of *S. molinae, S. leptostigma* and *S. laplaticum*.

Only *S. garciae, S. boergeri, S. molinae* and *S. leptostigma* among the wild species formed tubers without short-day treatment; *S. pamiricum* also formed them quite successfully. Several species segregated for the capacity to form tubers in long days; seedlings that formed tubers without short photoperiod appeared in the progenies of *S. garciae, S. dolichostigma, S. leptostigma, S. demissum* and others. All the cultivated species formed tubers more successfully under natural day length than under short days and several of the *S. andigenum* forms had tuber yields equal to those of domestic varieties. In trials at Novosibirsk in Siberia all the wild species flowered freely except *S. molinae*. In favourable years flowering was better in natural conditions but in unfavourable years the plants with short photoperiod flowered more freely. Tubers formed most freely in natural conditions and short photoperiod reduced the tuber yield. *S. molinae, S. schickii, S. jamesii* and *S. pamiricum* gave good yields of tubers even in unsatisfactory years. Mexican and some Peruvian and Bolivian forms of *S. andigenum* formed tubers without short photoperiod but forms from more equatorial latitudes did not. Most forms of *S. tuberosum* from Chile produced more tubers in wet years than dry years but ff. *sebolia, acuminatum* and *caniasii* yielded well even in dry years.

From the results it is concluded that such factors as temperature, humidity and light intensity are as important as photoperiod in influencing tuber formation.

4054 Nakauma, K. & Jinno, H.
**(Late potato cultivation in the wake of early rice cultivation).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1317–19. [Japanese].

Data are provided on the relative suitability of a series of Japanese potato varieties to the above system of intercropping.

4055 István, S.
A burgonya nemesítése. **(Potato breeding).**
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 113–19.

The chief aims of breeding work in Hungary are resistance to leaf-roll virus, X, Y and S viruses, blight and eelworm. The wild species *Solanum chacoense, S. demissum* and *S. andigenum* are being used as parents. Among high-yielding promising clones, K263, K4175, K217, S4 and S1430 are mentioned.

4056 Knutson, K., Line, R. F. & Eide, C. J.
**Varietal response to seed piece decay.**
Plant Dis. Reptr. 1959 : **43** : 546–48.

Apparant varietal differences in susceptibility were tested in twelve varieties in two seasons at the Minnesota Agricultural Experiment Station, and the results indicate that there is no significantly consistent varietal reaction.

4057 Bonde, R., Akeley, R. & Merriam, D.
**A method for testing seedling progenies of potato for ring-rot resistance.**
Plant Dis. Reptr. 1959 : **43** : 198–200.

Reaction of potato seedlings to *Corynebacterium sepedonicum* can be detected by root inoculation and susceptible ones removed from segregating lines more rapidly than by other methods. Resistance was found to be highest in the lines B721–1(R) selfed, B319–Me. 1(R) Nat. Pol. and Saranac (R) Nat. Pol., where the number of resistant seedlings approached 50%.

4058 Zadina, J.
Genetické zhodnocení některých odrůd bramborů odolných proti aktinomykosní strupovitosti (*Actinomyces scabies* [Thaxter] Güssow). [**A genetical evaluation of some potato varieties resistant to scab (*A. scabies* [Thaxter] Güssow)**].
Věd. Práce výzk. Ústav. Brambor. Havlíčkově Brodě 1958 : 57–79.

Of the varieties in the Czechoslovak collection, Kardinál [Cardinal], Kotnov and Blaník are particularly resistant to *Streptomyces scabies*. Genetical studies on resistance were made on a number of varieties, including known resistant and susceptible types, the tests being performed in a field infected with aggressive biotypes of *S. scabies*. It was found that for breeding purposes, Hindenburg, Carnea and Jubel [Jubilation] provide the most useful sources of resistance. A greater percentage of resistant progeny was obtained using a resistant seed parent than when a resistant pollen parent was used. Some American resistant varieties are listed.

4059 McCubbin, E. N. & Eddins, A. H.
**Potato variety tests at Hastings.**
Proc. Fla. hort. Soc. 1958 : **71** : 15–20.

The best varieties and seedlings were compared with Sebago for yield, maturity, recovery from frost, resistance to *Phytophthora infestans*, corky ringspot and other diseases and defects, skin colour and flesh of tubers. Merrimack, Pungo and Plymouth produce good yields of white potato suitable for crisps, are resistant to corky ringspot and though they do not possess all the good qualities of Sebago and Red Pontiac they are recommended for areas infested with corky ringspot. A white, B3602–4, and a red, B2368–4, seedling selection appear to be promising.

4060 Mastenbroek, C.
Het kweken van *Phytophthora*-resistente aardappelrassen. (**Breeding *Phytophthora*-resistant potato varieties**).
Zaadbelangen 1959 : **13** : p. 91.

In this report of a lecture given at the Central Bureau, Hoofddorp, Netherlands, the following topics are mentioned. *Solanum demissum* has been used as a source of dominant resistance genes conferring hypersensitivity. So far, four *R* genes have been found, by means of which 16 physiological races can be differentiated; but it is stressed that the finding of further factors is likely to lead to the recognition of even more races. It is thought desirable to combine the field resistance of some late varieties with a broad basis of hypersensitivity factors.

4061 Tanaka, I.
**(On combating potato blight).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 485–88. [Japanese].

The races of *Phytophthora infestans* prevalent in Japan are described and information is provided on material at present available in Japan which is resistant to these races.

4062 Thurston, H. D.
**The relative survival ability of races of *Phytophthora infestans* in mixtures.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–7024 : p. 1156. (Abst.).

In greenhouse experiments with mixtures of race 0 with one of five other races (1; 4; 1,4; 2,4; and 1,2,4), race 0 predominated or entirely displaced the other components after propagation of the mixtures on susceptible potato plants for two to nine generations. Isolates of race 0 were usually more infectious than the specialized races with which they were compared and this race appeared to be antagonistic to the other races with which it was mixed. "Water in which sporangia of all races had germinated reduced indirect germination of fresh sporangia of the same race and of most other races. It seems probable that the inhibition is caused by a substance produced by germinating sporangia of all races." No effect of one race upon another was detected when races were paired in all possible combinations on Lima-bean agar. Of the 23 isolates obtained at random from Cobbler, 20 belonged to race 0, 2 to race 4 and 1 to race 1. When Cobbler was separately inoculated in the field with one of five races, races 0, 4 and 1,2,4 were inferior to races 2,4 and 1 in aggressiveness, with race 0 probably the least aggressive of all. No explanation of the behaviour of race 0 in the latter experiment could be offered.

4063 Umaerus, V.
**The relationship between peroxidase activity in potato leaves and resistance to *Phytophthora infestans*.**
Amer. Potato J. 1959 : **36** : 124–31.

A detailed account is given of investigations already briefly reported [cf. XXVIII, 4380].

4064 Zadina, J.
Vzdornost divokých bramborů proti spongosporové strupovitosti (*Spongospora subterranea* Johnson). [**Resistance of wild potatoes to *Spongospora* powdery scab (*S. subterranea* Johnson)**].
Sborn. čsl. Acad. Zeměd. Věd : Řada rostlinná Výroba 1958 : **31** : 1115–26.

The results are reported of tests conducted in Czechoslovakia on 104 strains from 28 species of wild potato. Thirty-three of the strains were not attacked by *S. subterranea*; 14 of the resistant strains belonged to the *Acaulia* group and 13 and 6 to the *Commersoniana* and *Tuberosa* groups respectively.

4065 Ullrich, J.
Die Prüfungen von Kartoffelsorten und Kartoffelzuchtstämmen auf Resistenz gegenüber den Biotypen des Kartoffelkrebserregers (*Synchytrium endobioticum*). [**The testing of potato varieties and potato breeding lines against biotypes of potato wart (*S. endobioticum*)**].
NachrBl. dtsch. PflSchDienst., Stuttgart 1959 : **11** : 10–12.

An account is provided of tests conducted in Federal Germany, information being provided on the techniques used. Biotypes 1, 2, 6, 7 and 8 have been found. Mira, Argo and some breeding lines are resistant to all these biotypes and other varieties and lines are resistant to four biotypes.

4066 Zakopal, J. & Spitzová, B.
Příspěvek k otázce ras či biotypů (*formae speciales*) rakoviny bramborů *Synchytrium endobioticum* (*Schilb.*) *Perc.* v Československu. [**A contribution to the question of races or biotypes (*formae speciales*) of potato wart, *S. endobioticum* (Schilb.) Perc., in Czechoslovakia**].
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinńa Výroba 1958 : **31** : 999–1018.

Observations made on 316 potato varieties of the Czech world collection grown at different centres in Czechoslovakia indicated that there is only one biotype of *S. endobioticum* attacking potatoes in Czechoslovakia. This biotype appeared to be identical with the Dahlem biotype in Germany. It is also thought probable that the same biotype occurs in many other European countries and the USA. In only one case were results obtained which did not agree with those from the USSR; the variety Cobbler was attacked in Czechoslovakia but is resistant in the USSR.

4067 Ullrich, J.
Die internationale Kartoffelkrebstagung in Smolenice, ČSR, vom 4. bis 7.11.1958. (**The International Potato Wart Conference in Smolenice, Czechoslovakia, from 4 to 7 November 1958**).
NachrBl. dtsch. PflSchDienst., Stuttgart 1959 : **11** : 45–46.

At this conference, Vuittenez mentioned that only biotype 1 of *Synchytrium endobioticum* is known in France and, according to Săvulescu, only one biotype has been found in Rumania, where the pathogen has recently increased. Janežić reported that numerous varieties resistant to biotype 1 were grown in infested land in Yugoslavia and only Virginia was attacked. It was assumed that this indicated the existence of another biotype but this is still an open question for in Germany Virginia has also grown poorly in an area infested with biotype 1. Blattný described the history of biotype 3 occurring in southern Bohemia. According to Hey five biotypes are known in central Germany and there is probably another which attacks Fortuna. Four completely resistant potato varieties are known, Hilla, Mira, Argo and Zeisig. Braun reported that the cultivation of varieties resistant to biotype 1 led to the selection of other biotypes; he thought that resistance to this biotype should not be obligatory. Bojňanský supported this view, pointing out that hitherto it has not been possible to combine culinary quality, early maturity and resistance to *Synchytrium*. Fedotova reported that no physiological specialization of *Synchytrium* has been found in the USSR.

4068 Internationale Kartoffelkrebs-Tagung. (**The International Potato Wart Session**).
Kartoffelbau 1959 : **10** : 60–61.

[Cf. 4067].

4069 Kranz, J.
Über sortenbedingte Anfälligkeit der Kartoffelknolle für *Fusarium caeruleum* (Lib.) Sacc. und *Phoma foveata* Foister und ihre Beeinflussung durch den Anbauort. [**Varietal susceptibility of the potato tuber to *F. caeruleum* (Lib.) Sacc. and *Ph. foveata* Foister. and the influence of the place of cultivation**].
Phytopath. Z. 1959 : **35** : 135–47.

Nineteen varieties of potato grown in West Germany were tested for their susceptibility to

*F. caeruleum* (*Hypomyces solani*) and *Ph. foveata*. All the varieties were susceptible to both pathogens but, on the whole, the early varieties were more susceptible than the main-crop varieties. In some cases, the type of soil in which the tubers had been grown appeared to have influenced susceptibility but these effects were not statistically significant.

4070 Błaszczak, W.
Badania nad rizoktoniozą ziemniaków. Część I. Badania nad rizoktoniozą ziemniaków (*Rhizoctonia solani* K.) ze szczególnym uwzględnieniem jej zwalczania. Część II. Badania porównawcze 25 szczepów *Rhizoctonia solani* K. zebranych z ziem Polski. [**Studies on rhizoctoniosis of potatoes. I. Studies on rhizoctoniosis of potatoes (*Rh. solani* K.) with special reference to its control. II. Studies of 25 strains of *Rh. solani* K. collected on Polish soils**].
Poznań. Towarz. Przyjaciół Nauk Wydział mat.-przyrod. Prace Kom. Nauk roln. leśn. 1958 : **4** : No. 4 : 1–114.

In the first paper it is noted that four cultures studied in the laboratory showed distinct differences in number and arrangement of sclerotia, growth rate and other characters. In the second paper, data on morphological and physiological characters of 25 Polish strains are presented. Marked differences in virulence were detected, R–22 being the most virulent.

4071 Tyktin, N. V.
[**The resistance of potato to potato nematode (*Heterodera rostochiensis* W.)**].
Dokl. Vsesojuzn. Akad. seljskohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 9 : 24–28. [Russian].

As a preliminary to resistance breeding at the Institute of Plant Industry, many wild and primitive cultivated species were tested. Selection was based on cyst counts on roots of seedlings and of plants raised from tubers in soil artificially infested with the nematode. *Solanum ballsii* was the only species on the roots of which not a single cyst was found. Next in resistance came *S. catarthrum* and one of its hybrids. Fair resistance was also shown by some forms of *S. andigenum*, in particular var. *sihuanum* and ff. *mocca sencea* and *papa astilla*. *S. ballsii*, which flowered abundantly and formed tubers well under Leningrad conditions, was fertilized by a pollen mixture of *S. phureja* + Kameraz + *S. schreiteri*. The hybrid progeny gave segregates in respect of resistance in tests conducted in the Kaliningrad province, the number of resistant plants in a family varying from 0 to 12%. The most resistant hybrids were then crossed with Berlichingen, and a number of berries with a few seeds were obtained. *S. ballsii* also developed berries after pollinations by Parnassia or mixed pollen of Oktjabrenok [Little Octobrist] + Voran, but most of these berries were seedless. Hybrids of resistant clones of *S. catarthrum* x Berlichingen gave some resistant progeny. The percentage of flowers in the last cross that developed berries was high and the berries contained 20–70 seeds.

**Proceedings of the Symposium, Insect and Foodplant.**
Ent. exp. appl. 1958 : **1** : Pp. 118.

4072 *Torka, M. Über den Frasstest an* Leptinotarsa-*resistenten Kartoffeln.* (*On the feeding test by insects in* Leptinotarsa-*resistant potatoes*). (*pp. 3–8*).

An account is presented of the present position at the Max Planck Institute for Breeding Research, Ladenburg, with respect to breeding for resistance to *Leptinotarsa*. Plants of *Solanum chacoense* homozygous for resistance have been obtained; the chromosome number has been doubled by colchicine treatment and successful crosses effected with *S. tuberosum*. Resistance was lacking in the $F_1$ but the $F_2$ and other subsequent generations contained small percentages of resistant plants. By comparison, a cross between *S. demissum*, another resistant species, and *S. tuberosum* yielded 20% resistant plants in the $F_1$ and resistance soon disappeared in subsequent generations. Back crossing the resistant $F_2$ of *S. chacoense* x *S. tuberosum* to *S. tuberosum* to improve other agronomic characters resulted in a loss of resistance which then had to be reintroduced. However the prospects of breeding a variety both resistant and productive have now improved.

One of the difficulties in testing for resistance is that, whereas in one year a certain clone may be completely undamaged by the beetle, in another year, it may be readily eaten. This makes it necessary to carry out the tests for several years. It is considered important in making these tests to provide the beetle larvae with fresh young foliage and optimum conditions of temperature and humidity. Damage to the foliage may be assessed after allowing the larvae to eat for 24 or 48 hr. Since very little foliage is required in these tests, seedlings may be tested in their first year of growth.

Differences in behaviour have been found between larvae; some have been found to eat a little of the foliage of *S. chacoense* which is usually resistant. Occasionally such larvae develop into beetles when fed on *S. chacoense*. *S. chacoense* has a bitter taste resulting from the presence of six toxic alkaloids but resistant hybrids include bitter types and others with neutral taste. It is suggested that some of the susceptible hybrids which are not always eaten may contain a repulsive substance which is not identical with the resistant principle.

4073 *Trouvelot, B. L'immunité chez les Solanacées à l'égard du Doryphore.* (*Immunity in the Solanaceae with respect to the Colorado beetle*). (*pp. 9–13*).

Members of the Solanaceae cannot be divided into two groups, those attacked by *Leptinotarsa decemlineata* and those unattacked. Instead there exist various gradations in degree of attack. In analysing the immunity shown by some Solanaceae, it is necessary to examine the relationships between the insect and the host. With regard to the imago, these relationships are of three orders. Firstly there are factors controlling the arrival and stationing of the insect on the plant. So far it has not been shown that plants exert any attraction, specially at a distance. Whether or not an insect remains on a plant is determined by various factors, including microclimate, which depends on the habit and nature of the foliage, and tactile and gustatory stimuli provided by the plant. The following species were found to retain the imagos for some time, observations having been made on plants growing in full sun: *S. melongena*; *S. dulcamara*; spiny species like *S. rostratum*; and some tuberous forms such as *S. edinense*, *S. andigenum*, *S. maglia* and *S. demissum*. Somewhat less favoured by the adult insects are *S. heterodoxum*, *S. sisymbriifolium*, *Nicotiana alba*, *N. sanderae* and numerous *Lycopersicon* species. The insects stay for an even shorter time on forms of *S. nigrum*, *S. rantonetti* and *S. aculeatissimum*. The second phase in the interaction between adult insect and host concerns feeding behaviour; the intensity of the first attack and the persistence of the feeding have to be noted. Such observations have yielded a classification of species similar to that already described but with some differences. For example although imagos remain on *S. demissum* for some considerable time, they make only a slight attack on the foliage after the first few rapid bites. *S. tuberosum* 'Wohltmann' usually retains the imago for only a short space of time but if the insect is prevented from leaving the plant, it eats the foliage avidly; this also occurs on some *Lycopersicon* species.

Thirdly the effect of the plant on the physiology of the imago has to be considered; in particular the effect on fecundity is important for this largely determines the severity of the attack on the host. When species are rated according to this effect, it is found that *S. dulcamara*, *S. melongena* and *S. edinense* are severely attacked and *N. rustica*, *N. tabacum* and certain *Lycopersicon* species slightly. The adult insect appears to be very sensitive to the food supply. Larval development proceeds well on *S. marginatum*, *S. dulcamara*, *S. gilo* and *S. rostratum*; it is less good on *S. heterodoxum*, *S. aviculare*, *S. sisymbriifolium*, *S. balbisii* and *N. sanderae* and even worse on *S. demissum*, *S. commersonii*, *S. jamesii*, *S. polyadenium*, *S. nigrum* and *S. auriculatum*. On other species, including *N. tabacum*, *N. glauca*, *N. rustica* and *S. aculeatissimum*, the larvae hardly develop at all.

It is only by considering all these factors in several generations of the host plant that one can determine the relationships with the insect.

4074 *Schreiber, K. Über einige Inhaltsstoffe der Solanaceen und ihre Bedeutung für die Kartoffelkäferresistenz.* (*Some constituents of the Solanaceae and their importance for resistance to the Colorado beetle*). (*pp. 28–37*).

The substance of this paper is similar to that of one already summarized from another source [cf. XXVIII, 1834].

4075 *Kennedy, J. S. Physiological condition of the host-plant and susceptibility to aphid attack.* (*pp. 50–65*).

This analysis of the effects of physiological variation of the host crops upon susceptibility to attack by aphids of various genera includes a discussion of the nature of varietal differences in resistance and unpublished data on characteristics of the *Vicia faba* varieties Rastatt and Schlanstedt in relation to reaction to *Aphis fabae*. During the early and most critical part of the season, the relatively resistant variety Rastatt offered fewer preferred sites for colonization than the more susceptible Schlanstedt. Such sites consisted of the crevices between the developing flower buds near the plant tip and became available later on Rastatt than on Schlanstedt, the flower buds on Rastatt developing about two nodes higher than on Schlanstedt. When this difference in provision of preferred sites was found no longer, the aphids continued to prefer Schlanstedt, although by July Rastatt offered more favoured sites than the latter variety. During the period of flowering and

fruiting in June and July, Rastatt produced more shoots, leaves, flowers and pods per plant than Schlanstedt. Assuming that the total assimilation products of the two varieties are equal, an aphid feeding on the phloem sieve tubes supplying any one growing organ of Rastatt would be getting sap less rich in nutrients than from a corresponding organ of Schlanstedt, on account of the greater number of growing points in Rastatt. Differences in sieve-tube composition between varieties differing slightly in growth pattern may therefore possibly be responsible for disparities in aphid resistance. Ways in which this hypothesis could be tested, in the hope of finding information useful to the breeder, are briefly indicated.

4076 *Müller, H. J. The behaviour of* Aphis fabae *in selecting its host plants, especially different varieties of* Vicia faba. (*pp. 66–72*).

Experiments at the Plant Breeding Institute, Quedlinburg, Germany, demonstrated that differential initial infestation of the varieties Rastatt and Schlanstedt was due to the preferential behaviour of the winged aphids. Alighting upon plants of both varieties in equal numbers, in a few minutes 99% of them left Rastatt, whereas only 90% left Schlanstedt. The causes of the preferential behaviour are not yet known.

4077 Leszczenko, D. & Malec, K.
Badanie reakcji odmian ziemniaków na sztuczne niszczenie masy liściowej. (**Investigations on the reaction of potato varieties to artificial destruction of the foliage**).
Roczn. Nauk rol. : Ser. A. : 1957 : **74** : 651–56.

The effects of the destruction of 50% and 100% of the leaves in two different periods of growth corresponding to the periods of attack by the Colorado beetle were compared in eight varieties. Tuber yield decreased more after leaf removal during flowering than after removal at an earlier stage. Late varieties showed better leaf regeneration than early, Pierwiosnek [Primrose] being the most tolerant of leaf removal.

4078 Lipiński, S.
Hodowla odmian ziemniaka odpornych na stonkę (*Leptinotarsa decemlineata* Say.). [**Breeding of potato varieties resistant to Colorado beetle (*L. decemlineata* Say.)**].
Postępy Nauk Roln. 1957 : **4** : No. 6 : 29–36.

On a resistance scale in which the highly resistant species *Solanum demissum* has a value of 10 and the susceptible variety *S. tuberosum* 'Dar' [Gift] has 0, $F_1$ progenies of *S. demissum* x *S. tuberosum* had an average value of 1·25, with 43% having 0 and only 2% more than 5. Back crossing to *S. tuberosum* decreased the average to 0·8, with 51% at 0 and 1% above 5. On selfing the $F_1$, the average fell to 0·42 with none above 5, but crosses between $F_1$ hybrids gave better results, the average being 1·64, with 30% at 0 and 2% above 5.

A number of lines of *S. chacoense* had values above 10. Wild species of the series *Commersoniana* gave $F_1$ values of 8–10 and $F_2$ values of 5–6 when crossed with *S. tuberosum*. Demissin and chaconin play important parts in the respective resistances of *S. demissum* and *S. chacoense*.

4079 Bahareva, S. N.
(**Pollen fertility of some wild potato species resistant to Colorado beetle**).
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 26–30. [Russian].

Tabular data on pollen fertility of 31 wild species and 7 domestic varieties, obtained by the staining method with acetocarmine or by culture upon a nutrient substrate, suggest that pollen fertility of some wild species, in particular of sects. *Commersoniana, Glabrescentia* and *Pinnatisecta*, is low. This supports previous findings of unsuccessful hybridization in which these species were employed as ♂ parents of domestic varieties. It is suggested that in breeding potatoes for resistance to Colorado beetle the wild species should be used as ♀ parents and cultivars with highly fertile pollen as the ♂.

4080 Hamann, U.
Die Bedeutung des Rippenbräunevirus für die Pflanzkartoffelerzeugung in der DDR. (**The importance of the brown vein virus for the production of potato planting material in the German Democratic Republic**).
Dtsch. Landw., Berl. 1959 : **10** : 233–36.

Varieties grown in Eastern Germany are classified according to their resistance to the brown vein virus. Schwalbe [Swallow] is the most resistant. Also the effect of infection with this virus on tuber production is shown for some susceptible varieties.

4081 Arenz, B. & Hunnius, W.
Der Einfluss verschiedener Virusarten auf die Ertragsbildung bei der Kartoffel. (**The influence of different kinds of virus on yield in the potato**).
Bayer. landw. Jb. 1959 : **36** : 163–73.

An investigation carried out at Weihenstephan

with about 30 potato varieties is described. Healthy tubers and others infected with leaf-roll virus or a race of virus Y were grown in pots in the open and observations made on the effects of the virus infections on development of the plants. With respect to each virus, varieties differed markedly in the time when the disease broke out and in the severity and symptoms of the attack. There were also considerable differences in the effect on yield. In the 25 varieties tested with leaf-roll virus, the average decrease in yield as compared with that of healthy plants was 40·3%, decreases ranging between 100% for Apta and 1·2% for Lama being found. For the varieties infected with the old race of virus Y, the average decrease in yield was 50·5%; values varying between a decrease of 83·3% for Fabricia and 6·4% for Ute were found. Varieties showing a latent infection with the new virus Y (tobacco brown vein virus) showed an average yield decrease of 13·8%; in the varieties where the infection was manifest, the average decrease was 20·6%.

4082 Beemster, A. B. R.
Transport van X-virus in de aardappel (*Solanum tuberosum* L.) bij primaire infectie. [**Translocation of virus X in potato (*S. tuberosum* L.) in primary infections**].
Proefschr. LandbHoogesch Wageningen 1958 : Pp. 98; also Tijdschr. PlZiekt. 1958 : **64** : 165–262.

In inoculation tests with Bintje, Bevelander, Eigenheimer and Voran, all except Bevelander showed mature-plant resistance to translocation of the virus. Tests with Bintje indicated that mature-plant resistance comes into effect at the time of tuber initiation.

4083 Rozendaal, A.
Selectie- en keuringsproblemen rondom het "nieuwe" Y-virus. (**Problems of selection and inspection with respect to the "new" virus Y**).
Meded. Ned. Alg. Keuringsdienst Landbouwzaden Aardappelpootgoed 1959 : **16** : 1–4.

In inoculation tests of numerous varieties in the greenhouse, three main types of reaction to a new strain of virus Y were distinguished: (1) no symptoms but virus present and giving rise to symptoms after multiplication in Ambassadeur and Voran; (2) mosaic in the upper leaves; and (3) distinct mottling together with some vein necrosis. Symptoms appearing after multiplication generally differed from the primary symptoms. Only Maritta, which is also resistant to the old strain, remained free from virus. Problems of selecting virus-free material for multiplication are discussed.

4084 Webb, R. E. & Hougas, R. W.
**Preliminary evaluation of *Solanum* species and species hybrids for resistance to disease.**
Plant Dis. Reptr. 1959 : **43** : 144–51.

In a preliminary investigation at the Crops Research Division, US Department of Agriculture, Beltsville, Md., and the University of Wisconsin, about 200 selections were tested for disease resistance, with the following results. Resistance to virus A was found in *S. demissum* '161134.1', '161141.1' and '161367.1' and *S. sucrense* '230465'. Virus X was not detectably present 30 days after inoculation in selections of *S. acaule, S. cardiophyllum, S. chacoense, S. kurtzianum, S. maglia, S. phureja, S. stoloniferum, S. sucrense* and *S. andigenum*. Systemic infection by virus Y after either aphid or mechanical inoculation failed in selections of *S. chacoense, S. sambucinum, S. stoloniferum* and *S. verrucosum*. No selections were entirely resistant to leaf-roll virus, although some degree of resistance was found in controlled conditions. Resistance to *Verticillium albo-atrum* was found in selections of *S. chacoense, S. maglia, S. phureja, S. polyadenium* and *S. vernei* as well as in some unidentified species and interspecific hybrids. All interspecific hybrids were susceptible to spindle tuber. Resistance to *Streptomyces scabies* was highest in 208350F1279, 208353F1902, *S. tuberosum* '210062 Argentina', and *S. demissum* x *S. rybinii* x *S. tuberosum* '215622SSRPS2070(64)' and '215623SSRPB2070 (69).

4085 Ross, H.
Virusresistenzzüchtung an der Kartoffel. (**Breeding for virus resistance in the potato**).
Europ. Potato J. 1958 : **1** : No. 4 : 1–19.

This detailed survey provides information on sources, type and mode of inheritance of resistance to leaf roll, Y, A and X viruses and also information on the position reached in breeding resistant varieties. Three types of resistance occur, resistance to infection, hypersensitivity and immunity.

So far only resistance to infection has been found for the leaf-roll virus, this resistance being polygenically controlled and dominant [cf. XXVII, 3196]. Hybrids descended from the wild species *Solanum acaule, S. andigenum, S. chacoense* and *S. demissum* are more resistant

than varieties of *S. tuberosum*. It has not been possible to find resistance in the wild species themselves. Therefore either the resistance occurs in only special types of the wild species or, what is more likely, the resistance of hybrids of wild species x *S. tuberosum* is due to a complementary action of genes from both species. It is thought that further improvement in resistance may be effected by combining the most resistant hybrids.

As regards resistance to virus Y, this is polygenically inherited in varieties of *S. tuberosum* and *S. demissum*. *S. stoloniferum* and *S. chacoense* provide immunity to this virus. It has recently been found that in *S. stoloniferum* a series of three alleles affect resistance to viruses Y and A. The dominant gene *Ry* confers immunity to both viruses; *ryn* is responsible for hypersensitivity to Y and susceptibility to A and is dominant to *ry* which causes susceptibility to both viruses. Certain polygenes modify the effect of *Ry* to hypersensitivity. *Ry* is effective against all races of virus Y. From *S. stoloniferum*, hybrids highly resistant to virus Y have been obtained; these possess other desirable characters, including resistance to *Phytophthora*. Breeding has now reached the fifth back-cross generation, which segregated in a ratio of about 1 : 1 for susceptible and resistant plants, there being a slight excess of susceptible plants as a result of gamete elimination.

Many varieties are hypersensitive to virus A, the resistance being inherited in a monomeric dominant manner. Also certain varieties from Scotland show hypersensitivity to virus X; the genes *Nx* and *Nb* are each responsible for resistance to specific groups of the virus. A cross of *S. andigenum*, 41956, and a line of the same species, CPC1673, show extreme resistance to virus X. *S. acaule* also shows high resistance, this being a monomeric dominant character. The gene responsible is *Rx* and resistance is independent of the strain of virus X.

Some progress has been made in combining resistance to the four viruses; this may be done by crossing *S. acaule* with *S. stoloniferum* or by crossing their *S. tuberosum* hybrids.

4086 Dorst, J. C.
**Some impressions of the "Institut für Pflanzenzüchtung Gross-Lüsewitz".**
Euphytica, Wageningen 1958 : **7** : 237–40.

An account of work on potato breeding seen at the Gross-Lüsewitz Plant Breeding Institute during the author's visit in 1958 is reported, special reference being made to investigations on degeneration. Resistance to degeneration caused by various viruses is found in Meise [Titmouse], Amsel [Blackbird] and Drossel [Thrush], all from Aquila x Flava, Schwalbe [Swallow], from Aquila x Capella, Spatz [Sparrow], from Capella x BRA D 79, Star [Starling], from Capella x Aquila, and Fink [Finch], from Aquila x (Voran x Mittelfrühe [Medium Early]) [cf. XXVII, 1917 and XXIX, 1706]. Argo (Capella x BRA 9089) and Zeisig [Siskin] (Aquila x Hilla) are resistant to both the old and the new strain of wart. Among many crosses, those involving *Solanum tuberosum* ssp. *andigenum* generally showed a very high percentage of plants with virus diseases. Other work includes breeding for earliness and for blight resistance.

4087 Hansen, A. J.
**A comparison of methods for inducing mutations in potato virus X.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7491 : p. 1504. (Abst.).

In view of the failure to induce pathogenic mutants of three strains of potato virus X by heat treatment or ultraviolet irradiation, it is suggested that so far as breeding for resistance to virus X is concerned, it is more practicable in testing to make use of natural variation in the virus than to attempt to increase the range of strains by inducing mutations.

4088 de Jong, W. H. & Hofstra, D.
**The keeping quality of seed potatoes.**
Europ. Potato J. 1958 : **1** : No. 4 : 33–36.

Data are provided on the stand of the crop of 10 varieties after 10 months and after 1 year and 10 months storage of the tubers. During storage the tubers were kept at 2° C. to prevent germination. Before planting out in May the tubers had been pregerminated; the stand was examined in June. The varieties Meerlander, Noordeling, Bevelander and Libertas gave almost as good results in the second year as in the first; the yields obtained in the two years were also similar. Tubers of the other varieties had deteriorated and the stands were poor in the second year.

4089 Mashimo, I. & Sato, H.
**(X-ray-induced mutations in sweet potato).**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 233–37. [Japanese].

Young shoots of Norin 1 [Ministry of Agriculture and Forestry 1], which has brownish red tubers, were irradiated with 5000–20,000 r. Mutants

were obtained and grown as far as the $X_4$ tuber generations. The principal changes were in respect of tuber colour and stem length and thickness.

4090 Sakai, K. & Hirosaki, S.
**(Studies on the rate of tuberization of the sweet potato. I. The relations between various characters and tuberization).**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 303–04. [Japanese].

A comparative investigation was made of root-tuber development in 30 varieties dug at an early and at a late date. Information is provided on tuber production at each digging, the tuber/root ratio and dry matter content.

4091 Armstrong, G. M. & Armstrong, J. K.
**The *Fusarium* wilt complex as related to the sweet potato.**
Plant Dis. Reptr. 1958 : **42** : 1319–29.

The pathogenicity of two races of wilt *Fusarium* is described. Race 1 causes wilt of sweet potato and Burley tobacco, and was obtained from Porto Rico sweet potato. Race 2 causes wilt in sweet potato and both Burley and flue-cured tobacco and was obtained from flue-cured tobacco and from Porto Rico sweet potato. Cultures obtained from these isolates showed great variability and practically every form in the *Elegans* section of *Fusarium* was represented. Race 1 appears somewhat more virulent than race 2 on resistant varieties of sweet potato. Variety Tinian is highly resistant to both races, B6313 rather less so.
The pathogenicity of other wilt *Fusaria* on Porto Rico sweet potato was also tested, with negative results; conversely neither race of sweet potato wilt *Fusarium* produced symptoms on various other species.

## FIBRES

4092 Activité de l'I.R.C.T. 1956. **(The work of the Institute for Research on Cotton and Exotic Textiles 1956).**
Cot. et Fibr. trop. 1958 : **13** : 1–237.

This report deals primarily with the breeding of cotton and cotton varietal trials in French Africa; work on *Urena, Hibiscus* and sisal is also mentioned.

*French Equatorial Africa*
At Bambari, breeding for resistance to *Xanthomonas malvacearum* has continued, a number of new hybridizations being effected [cf. XXVIII, 4424]. Tabulated data are provided on the general performance of these hybrids and other selected lines. In the varietal trials several varieties were found to be resistant to *X. malvacearum* or *Fusarium vasinfectum.* Réba TK–1 has shown good resistance to both these pathogens: two lines with improved productivity have been selected from this variety. Attempts are being made at Bassangoa to breed a variety superior to Allen 150; information is provided on the principal characters of some of the breeding lines. Lines A49T and A50T, reselected at Bambari, were unharmed by black arm and jassids in tests at Tikem. A few varieties showed some resistance to *Lygus* or *Empoasca* at Bebedjia. A series of new hybridizations were also effected at this station.

*French West Africa*
Studies were continued at Bouaké with selections of *G. barbadense* from the Ivory Coast and Togo. Amongst the hybrids under study, one line with a fibre length of 39·4 mm. and another with a good Pressley index were found. At M'Pesoba selection from the hybrids N'Kourala x *G. punctatum* and Allen x *G. punctatum* has continued. Mass-pedigree selection with Ishan and TsI cottons is in progress at the D'Anie Mono station.

*French North Africa*
At the Tadla Station, Morocco, selections are being made from Pima 32 which almost equals Pima 67 in productivity and has stronger fibre. Three new hybrids are to be retained. Tadla 2 (Pima 67 x 1515) has outyielded Giza 31; this hybrid has been crossed with other varieties and hybrids with a view to improving the Pressley index. Tadla 3 (Pima 67 x Amun) has particularly strong fibre. Tabulated information is also provided on the principal characters of some newer hybrids. Of the $F_4$ hybrids, H81 (Ashmuni x Bar 5/5) is high yielding, has a good Pressley index and is resistant to black arm; other hybrids have also shown good productivity or superior fibre characters. Varieties and lines were tested for resistance to *X. malvacearum*; Pima varieties with the exception of Pima 67 M151 showed good resistance. In Algeria various hybrids in different stages of development are being studied; their principal characters are listed.

4093 Sonne Frederiksen, P.
2. internationale kongres for hørforskere afholdt i Kortrijk 5.-8. juni 1956. **(Second international congress for flax growers, held in Kortrijk, 5-8 June, 1956).**
Lin 1956 : **10** : 53–63.

At the above congress, a paper by G. C. Whitting

was read in which it was reported that the corolla colour of each of the flax groups with normal dark-violet corollas is due to a single anthocyanin, probably a delphinidin monoglycoside; traces of other anthocyanins are present. No anthocyanins occur in white-flowered varieties while four are found in pink-flowered forms.

R. von Sengbusch reported the development of new hemp strains with 20–24% pure fibre content and yields of 2200–2400 kg./ha. pure fibre. Mention of promising monecious hemps in France was made by A. Nicot, who also noted that Bredemann 24, which has a very high fibre content, can be used as a raw material for the paper industry.

4094 **(Research with fibre plants at the USSR Institute of Plant Industry).** Len i Konoplja (Flax & Hemp) 1958 : No. 6 : 45–48. [Russian].

Breeding of flax, linseed, hemp, jute, *Abutilon* and kenaf at the Institute of Plant Industry and other research stations utilizing the collection of fibre plants of the institute is among the topics discussed.

**Progress Reports from Experiment Stations, season 1956-1957.** Emp. Cott. Gr. Corp. Lond. 1957–58.

4095 *Ruston, D. F. Survey of progress reports for the season 1956–57.* (*pp. 1–12*).

Cotton breeding is among the activities briefly reviewed.

*Cotton Research Station, Namulonge, Uganda. Progress report for the season 1956–57.*

4096 *Wickens, G. M. & Logan, C. Plant pathology.* (*pp. 32–37*).

The needle and brush methods of inoculating bolls with bacterial blight (*Xanthomonas malvacearum*) were compared [XXVIII, 4459]. When stem-inoculated with *Verticilium* wilt, DE715/6M [cf. 4098] had a score of 1·4 on a 0–5 grading for mean severity of attack, as against 3·0 for S47 and U4/8161.

4097 *Manning, H. L., Faulkner, R. C. & Kibukamusoke, D. E. B. Plant breeding.* (*pp. 37–53*).

The modal bulk 7MB of BP52 gave an increase in lint per acre of more than 21% over the local commercial BP52 in district trials [cf. 3171]. This result agrees well with the expected value of 120·2% from the regression equation $Ye = 102{\cdot}83 + 2{\cdot}485X$, where $X$ is the modal bulk generation.

The modal bulk 10MB was selected by the standard technique [XXI, 2822]. It is of interest to note that both its lint per seed (0·536 dg.) and seed weight (1·105 dg.) were higher than in any previous season. With a realized advance of about 2·5% in lint yield per annum, this method of selection continues to be worth while. With a mean maximum halo length of 34·3 mm. for the 98 selected plants, 10MB may be considered as the BP52 stock with the longest and finest staple.

Improvement of the yield of BP52 by progeny-row breeding also continued. Equating the yield of the control 7MB to 120·2%, the mean advance of seven progeny bulks tested in five localities proved to be 33% over the original material. This advance represents an annual increment of about 4%. Two of the strains, C(55)6 and C(55)3, were over 20% higher in yield than 7MB, with an expectation of being more than 40% better than the original.

Strains C(54)41, C(53)41 and C(54)3 outyielded local BP52 in the district trials. Multiline NC57, now undergoing multiplication, includes these strains or their derivatives in its composition.

It is proposed to compare modal bulk lines of UPA [(MU8 x $BP52^2$) x Albar 51] and of Albar strains with "static bulks", the latter type of bulk being obtained "by mixing each year equal numbers of seeds from every plant in the previous year's static bulk." The replicated progeny-row system was applied to this material for the first time, selection being effected for yield, lint quality and resistance to bacterial blight in boll inoculations as indicated by mean lesion size per plot. The expected yield advance of the selected progenies is 4·0% in Albar and 2·0% in UPA. The annual increment in this material may be expected to be somewhat low, since improvement in lint quality must be given priority.

Among the American strains tested, Acala x Hartsville hybrids showed most resistance to *Verticillium* wilt, when stem-inoculated, but were not superior to local B181 x BP50 The mean rating of the latter was 1·7 as against 3·7 for the susceptible control (U4/8161). Resistant plants were selfed, the seed being used to establish a panmictic bulk and progeny rows.

4098 *Walton, P. D. Cotton breeding at Serere.* (*pp. 44–51*).

Modal bulks of DE (BP50 x B181), BP50, N17, UPA, Albar, S47 and S4108 were made on the basis of selection for lint index, 100-seed weight and lint length. From the district trials, it was concluded that replacement of S47 by DE715/6M would lead to some increase in yield over S47, and that higher yields would be obtained in Busoga by the issue of a BP52 derivative.

*Tanganyika Territory, Lake Province. Progress report for the season 1956–57.*

4099 *Peat, J. E. & Brown, K. J. Cotton breeding.* (*pp. 13–18*).
The main trials at Ukiriguru were concerned with testing segregates from the best local material against the parent strains. Some selections showed promise of giving better yarn than Uk55. The results from the district trials supported the policy of successive seed issues of composite strains, with Uk55 now replacing Uk51.

4100 *Arnold, M. H. Diseases.* (*pp. 18–22*).
Bacterial-blight resistant selections from back crosses having Albar 51 as the nonrecurrent parent compared favourably with Uk55 in yield and fibre characteristics. $BC_3$ progenies from the project in which Sakel BAR 14/38 ($B_2B_{6m}$) was used as the source of bacterial-blight resistance were disappointing, off-types typical of *G. hirsutum* x *G. barbadense* hybrids being of frequent occurrence. Nearly 50 resistant plants which were also resistant to jassid and promising in appearance were however selected for further back crossing.
Selection for high yield in strains of local origin has been associated with increases in resistance to blight. Uk55 showed superiority in stem resistance over previous seed issues.

*Tanganyika Territory, Eastern Province. Progress report for the season 1957.*

4101 *Smith, R. Plant breeding.* (*pp. 5–10*).
In work on cotton for unirrigated conditions, Ilonga 58, a multiline issue composed of seven strains derived from two parental types, is to be multiplied as a replacement of 47/10 [XXVIII, 3174]. During the season under review, Ilonga 58 outyielded 47/10 by 25%. It also has the advantages of higher ginning outturn and fibre maturity, as well as jassid tolerance.

*Kenya. Progress report for the season 1956–57.*

4102 *Hastie, M. S. Nyanza Province. Cotton experiments.* (*pp. 1–6*).
The results of trials in Central and Elgon Nyanza revealed no significant differences between S47 and DE715/6 in yield of seed cotton but the lower degree of susceptibility to *Verticillium* wilt and better yarn appearance of the latter told in favour of substituting this variety for S47.

4103 *Coast Province.* (*pp. 10–14*).
The jassid resistance of Uk51 and Uk48 was highly satisfactory and appeared to be sufficient for conditions in the Coastal Province. Uk51 is to replace N17.

*Republic of the Sudan. Cotton Breeding Stations. Progress report for the season 1956–57.*

4104 *Rose, M. F., Hughes, L. C. & Low, A. The Gezira Research Station.* (*pp. 3–18*).
Regarding the production of a Sakel type equivalent in all respects to commercial X1730A and carrying $B_2B_3$ for black-arm resistance, observations on segregates from the second back cross to BAR 14/25 ($B_2B_3$) indicate that back crossing need not be continued. In the development of a leaf-curl resistant type of Sakel, however, back crossing to BAR 14/25 will have to be continued considerably beyond this stage.
Progress was achieved in combining the fibre characteristics of Tangüis with the earliness and black-arm resistance of BAR 14/25.
The project on the transference of partial lint-retention from *Gossypium contextum* and Stormmaster to Sakel has been dropped, since $F_2$ selections of third back crosses proved disappointing in yield and retention [cf. 3176].
In limited tests at Medani, X1730A substrains carrying $B_2$, $B_3$ and $B_6$ derived from Sakel have shown good yielding capacity and ginning outturn and, with one exception, complete immunity from systemic attack by black arm.
In breeding for jassid resistance, emphasis is to be laid on $H_3$ for "modified hairiness", instead of $H_1$, since the latter gene plus its modifier complex in a *G. barbadense* background reduces yield and grade too much [cf. 3177].
Selection of BAR 14/25 for salt tolerance by the method previously described [cf. 3176] has failed to give a significant improvement.
The results of the standard variety trials on Domains Sakel and X1730A and BAR strains of these cottons are reported.
In Upland breeding, transference of (1) the strength of Hopi Acala to BAR 7/8.2 [BAR SP84 ($B_2B_3$)] and BAR 11/7 [XA129 ($B_2B_3$)] and (2) the quality of BAR 11/7 to the productive strain BAR 7/8.2 is in progress.

4105 *Dark, S. O. S. & Saunders, J. H. Shambat Station.* (*pp. 18–27*).
With the exception of $B_2B_3B_6$ stocks, which showed complete immunity, experimental material at the Gezira station suffered from systemic attack by black arm. All the $B_2B_3$ types, hitherto considered to be nearly immune, showed high-grade susceptibility. A similar change in black-arm attack also occurred at the Shambat station. The special symptoms of this attack are ascribed to unusual weather conditions, causing water logging of the plants.
In view of the inadequacy of $B_2B_3$ resistance, development of cottons carrying $B_6$ has become

a task of first importance. The Sakel type BAR 14/48 and X1730A types BAR 4/25 and BAR 5/7, all with $B_2$, $B_3$ and $B_6$, have been sent to Medani for preliminary testing.

Transferences of $B_2B_3$, $B_2B_6$ and $B_2B_3B_6$ to Karnak, Pima $S_1$ and Acala 4–4–2 are proceeding. Another transference of $B_2B_6$ to BP52 has been completed. Synthesis of $B_2B_6$ and $B_2B_3B_6$ strains of American Upland derived from PSS, SP84 and Wilds SUS16 is under way.

Investigation of the genes for black-arm resistance transferred from *G. herbaceum* to Sakel continued.

Work on jassid resistance was confined to securing lines homozygous for $B_2B_3$, since jassid resistance without black-arm resistance would be unacceptable in the Gezira. Progenies considered to be homozygous for these two $B$ genes were selected from material homozygous for $H_1$ or $H_1H_3$. Although most lines show very satisfactory density of hair, the length is still somewhat too short. The genetic background of *G. barbadense* appears to have the effect of shortening the good hair length transferred from other types. The results of other work on hairiness suggest however that this difficulty may be overcome and that major genes for length exist.

At Medani, three families of the seventh back cross in the transference of the character of 4 locules from *G. hirsutum* to Sakel $B_2B_3$ were tested for yield and seed qualities. The mean number of locules per boll was 3·8 but a sterility factor appeared to be present. Transference of the multilocular character to Sakel and X1730A derivatives carrying $B_2B_3B_6$ continued. No evidence was obtained in contradiction of the hypothesis that high number of locules depends on a major gene acting in conjunction with a polygenic system [XXVIII, 3177]. Increase in ovule number has resulted in increased yield. The families with high ovule number were generally inferior to the Sakel controls in quality and lint length; it is however pointed out that as yet no selection has been carried out for these characters.

Progenies from back crosses of *G. anomadense* x BAR 14/25 to the latter are to be studied. Of particular interest are those carrying *G. anomalum* genes for hairiness, since $H_1$ and $H_3$ found in the New World cottons will ultimately be tested for homology with these genes.

Characters of *G. triphyllum* are being imparted to *G. anomalum* in order to compare the two species, both of which carry genome B.

The inheritance of bract characteristics in diploid species is under investigation.

Attempts to transfer high lint strength from *G. thurbadense* to Sakel and boll-worm resistance from *G. thurberi* to the Upland XA129 type BAR 11/7 ($B_2B_3$) continued.

Resistance to leaf curl is being introduced into BAR 14/25 from X1730A cotton, which shows only 25% susceptibility. Using MU8b and Ferguson, transference of resistance to this disease from *G. hirsutum* to Sakel and X1730A derivatives is also under way.

4106 *Rose, M. F., Low, A. & Hannay, H. E. Kadugli Station.* (*pp. 28–34*).

BAR 7/8.3, selected for reduced seed-coat neppiness, had 38% seed-coat nep, as against 47·2% in BAR 7/8.1. This reduction was significant at the 5% level and indicates that with a single filter an immediate improvement can be effected [XXVIII, 3178].

4107 *Munro, J. M. Nyasaland. Progress report for the season 1956–57.* (*pp. 1–12*).

Since CL20 has given disappointing results for the season under review, its distribution is not after all to be undertaken [cf. 3179]. A637, a selection of Albar 51 from Uganda, is however to be multiplied to replace CLB, to which it is superior in yield, ginning percentage, lint quality and bacterial-blight resistance. Only a few of the selections from Albar 49 x CL20 and Albar 49 x BP52 x CL20 have shown improvement over CLB in yield or ginning outturn. Attention is therefore to be directed mainly to Albar 51 and its derivatives. Each of the Albar 51 strains A629, A637, A640 and A474 has been crossed with CL20, A618, Uk51 and C(50)20.

*Northern Nigeria. Progress report for the season 1956–57.*

4108 *King, H. E. & Lawes, D. A. Plant breeding.* (*pp. 3–6*).

The superiority of 26J over its parent Samaru 26C was confirmed [XXVIII, 3180]. Breeding was concentrated on reselection within local stocks of Allen. Difficulty will however probably be experienced in advancing the lint yield much further without reduction in lint length, since high yield has tended to be associated with a lint length below the average.

4109 *Anthony, K. R. M. & Ogborn, J. E. A. Aden Protectorate. Research section, El Kod. Progress report for the season 1956–57.* (*pp. 1–13*).

Selection of AB3 (bulk filter of X1730) and BAR XL1 (first filter of BAR 1730L) for greater length and regularity of staple continued. In the attempt to transfer the resistance

to Abyan root rot of Wilds Early to the X1730A type, the fourth back cross was made to BAR XL1. The amount of outcrossing to be expected under conditions at Giar Farm is being determined, using the *G. arboreum* gene for red colour in BAR 5/6.

4110 *Spence, J. R., Cave, C. T. & Lake, E. B. West Indies. Cotton experiment stations. Progress report for the season 1956–57.* (*pp. 1–10*).

The trial of Sea Island cottons for reaction to *Fusarium* wilt in St. Vincent continued. MSI and Seabrook, with respectively 95·7 and 98·9% of the plants free from wilt at the end of the season, were the most resistant. Selection of MSI, VH8 and VH10 continued. In both Antigua and Montserrat, VH10 outyielded MSI and VH8.

4111 Carrante, V.
La cotonicoltura meridionale richiede la difesa delle sementi adatte quale completamento della tecnica colturale e delle propizie condizioni di ambiente. (**Southern cotton growing requires control of adapted seed as a supplement to technique of cultivation and suitable conditions of environment**). Stazione Agraria Sperimentale di Bari 1957 : Pp. 21.

Since Italy has attained self sufficiency in wheat, other crops are coming more into the picture and one of these is cotton in the southern provinces of Puglia and Lucania. The importance in this connexion of using good seed is emphasized; this is taken to apply to freedom from disease, genetic purity and correct variety. Tests are in progress at the Bari experimental station with varieties introduced from Russia, Greece, the USA, Morocco and Sicily. The earliest to flower were 2298 and 1306 from Russia and 2 Gamma and 2 Gamma C from Greece. The shortest period from bud formation to boll dehiscence was in Kanno 14 from Sicily and in 3210 from Russia. The Greek varieties were rather inferior in quality.

4112 **Thirty-Sixth Annual Report of the Indian Central Cotton Committee for the year ended 31 August, 1957** : Pp. 129.

*Genetics*

Further investigations were carried out on the inheritance of lint and fuzz colour in Upland. Genetical data were obtained on seed-fuzz intensity and spot size in Asiatic cottons. Progress has been made in the transference of dominant *Li* genes for lint production from *Gossypium anomalum* to cultivated Asiatic cottons. This species has so far been found to contain $Li_a$, $Li_b$, $Li_c$ and $Li_d$.

*Bombay*

In the scheme for improving *G. arboreum* for the Khandesh tract, Y1 again surpassed Virnar in fibre properties while three new cultures exceeded Virnar in yield.

In work on Mathio, CJ73 (C520 x Jarila) has shown an all-round superiority over Pratap in large-scale trials during the past six years [cf. XXVIII, 1847].

Testing of strains developed by interspecific hybridization at Surat continued. The Indo-American strains 170–Co.2 and 134–Co.2–M, possessing extra long staple, exhibited promise for certain districts. I–S–C–67, 68–G–4 and 134–Co.2–M21, resistant to jassid and black arm and also with extra long staple, were notable for their high yield, which exceeded that of 134–Co.2–M. Other material studied consisted of a large number of selections synthesized from a wide range of parents and comprising crosses *inter se* between hybrid derivatives, annual-perennial combinations, *G. hirsutum* x *G. barbadense*, crosses with wild species and combinations involving early-maturing selections.

In breeding for wilt resistance at Poona, derivatives of Digvijay, Vijalpa and crosses involving *G. arboreum* from Madras, Virnar and Dhulia–2 in their parentage were among the selections showing resistance.

Work on *G. arboreum* at Akola has resulted in strains showing promise of surpassing H420 in staple length, ginning outturn and spinning capacity.

In the scheme on breeding American cotton at Achalpur, some new strains were better than B0394 in ginning percentage and halo length.

Improvement of cotton for the Parbhani district is directed towards developing strains superior to Daulat in fibre length, ginning percentage, boll size and wilt resistance. Some new strains exhibited superiority over Daulat in various respects, e.g. 4166 (a selection from bulk Gaorani) gave higher yields and was highly resistant to wilt, although it had the defects of later maturity and slight inferiority in spinning performance.

Progress has been made in the project in the Aurangabad and Bhir districts where strains of the Verum type improved in wilt resistance, yield and ginning outturn are required.

*Mysore*

The search for Upland strains superior to MA5, particularly in fibre properties and red-leaf resistance, continued.

In breeding Cambodia in the Bellary district, two strains combining all the desired economic characters have been secured: 5110 (MA2 x 6113–F1 x HA11 x HA11 x 2196–4) and 5216 (2196–4 x MA2 x 6113–F1 x HA11 x MA2 x 2196–4). The strains are now ready for tests on cultivators' plots.

The scheme on Westerns has resulted in two strains, 4282 and 3870–IV–I, with better lint qualities and ginning percentage than Westerns–1 and equalling it in yield.

The attempt to breed an Upland variety equal to Laxmi in fibre quality but without its defect of susceptibility to red leaf and black arm continued in the Bombay-Karnatak area. Of the interspecific derivatives tested, some were not only highly resistant to black arm but also superior to Laxmi in yield and equal to it in quality.

In the scheme for perennial cottons at Dharwar, the Asiatic $F_1$ hybrids G–6 x BC–1–2 and Gajjar White x BC–1–2 showed promise as first-year ratoons. Among the $F_1$s with American cottons as parents, those involving Quebradinho, Moco, MCU2, 170–Co.2, XAB–5, 2196–BK, YS, 134CW and 125–Co.2–18 gave good yields. Of the $F_1$s of crosses between Jayadhar and black-arm resistant types, studied as third-year ratoons, Jayadhar x 2196–BK gave the highest yield.

*Punjab*

In the project for the south-eastern districts, progress has been made in developing American strains with long staple and higher ginning outturn than the standard 216F and H14. A secondary aim is breeding a high-yielding Asiatic cotton capable of spinning 15–20s HSC. DC109 showed promise of answering this requirement, exceeding the control, M60–A2, in both yield and spinning capacity (23s HSC).

In work on American cotton with extra long staple ($1\frac{1}{8}$ in. and over), centred at Abohar, several strains were superior to 320F in yield, fibre length and other properties.

In the scheme on American cotton for the central and submontane areas, strains at various stages of testing showed improvement over 320F in one or more economic characters.

*Madras*

In improving long-stapled American cotton as a winter crop in the central districts, the new strain 9030G again gave a good performance, surpassing MCU1 in yield, ginning percentage and fineness [cf. *loc. cit.*].

In the scheme to produce Upland strains with a fibre length exceeding $1\frac{1}{16}$ in. and capable of maturing in $5\frac{1}{2}$ months, L0509, L0299 and L0313, all derivatives of MCU2 x Kampala exceeded MCU2 in ginning outturn, fibre length and spinning performance.

In tests of strains resulting from work on Cambodia for nonirrigated conditions, 9030–8–5 surpassed MCU1 in ginning percentage and fibre properties [cf. *loc. cit.*].

In the scheme on Tinnevelly and Karanganni cottons, strains with a fibre length of over $\frac{5}{16}$ in. and other desired improvements have been bred.

*Andhra*

In the scheme to develop white-linted *G. arboreum* for the Northerns tract, some of the material at an early stage of testing was better than N14 in yield, halo length and ginning outturn.

Improvement of Cambodia at Nandyal and of white-linted cotton for the Coconadas tract continued.

*Rajasthan*

Some of the strains of American cotton tested under irrigated conditions in Mewar were superior to Indore 1 in one or more respects.

*Madhya Pradesh*

The results of trials of strains of local and American cotton of various origins are summarized. Some of the strains showing promise were derivatives of interspecific crosses involving *G. thurberi* and *G. tomentosum*.

*Uttar Pradesh*

In the improvement of Asiatic cotton in the western and central districts, a derivative of 35/4 x Parbhani G703 outyielded the control (35/1) in yield in the main trial and equalled it in spinning capacity [cf. *loc. cit.*]. In other trials, the four strains 35/1 x Jarila, Bani x C520, C50 x G125 x C520 and C520 x GLB5 x C520 equalled 35/1 in yield but surpassed it in quality. Bani x C520 was better in yarn strength than 35/1.

In work on Asiatic cotton for the Rohilkhand Tarai area, a strain from 35/4 x Parb. G703 and another from C520 x C402 outyielded 35/1 at Nagina and Meerut respectively. The two strains had a spinning value of about 20s HSC, as against the value of 13s HSC for 35/1. Derivatives from crosses involving 197–3 were superior to 35/1 in both yield and quality.

*Assam*

The project on the development of high-yielding strains of coarse short-stapled cotton with high ginning outturn continued.

*Orissa*

The results of trials of named varieties of American cotton are reported.

*All India*

A scheme for the increased production and improvement of Sea Island has been launched. Andrews is to be subjected to selection for fibre strength and ginning percentage.

4113 **(Cotton growing in Persia. The Persian agricultural delegation tells about cotton growing in their country).**
Hlopkovodstvo (Cotton Growing) 1958 : No. 8 : 60–61. [Russian].

This report describes the principal cultivars, all except Bumi [Native] being American varieties. Bumi is a late variety with a lint length of 25 mm. Mention is made of E22 and E29 which were obtained by hybridization involving local material at Veramin. These new varieties are interesting for high yield and resistance to damage by wind, diseases and pests, in particular *Tetranychus urtica* and *Heliothis obsoleta*.

4114 Calzada Benza, J.
Selecciones de algodón para los valles de la Costa Central. **(Cotton selections for the valleys of the Costa Central).**
Inform. Div. Exp. agríc., Lima 1958 : No. 60 : Pp. 41. (Mimeographed).

Data on the yield, fibre length, fibre percentage and boll weight are given for 34 selections tested in 1954–55 and 1955–56 in the central coastal area of Peru. SNA246, CP48, Cñ281–51, LM1041–49 and LMWI–52 were best on the average for all the valleys of the area, surpassing IM–7–35 in both yield and value of the crops; details of their disease resistance, earliness and fibre characteristics are included. The selections which did best in each of the eight valleys in which trials were conducted are listed.

4115 Saunders, J. H.
**Studies in wild species of cotton. 1. Variation within *Gossypium anomalum*.**
Heredity 1959 : **13** : 249–60.

Attention is drawn to the uniformity of representatives of *G. anomalum* in the collection maintained at Shambat, Sudan, although they originated from widely separated areas. Genetical investigations were carried out on three types. No final conclusions could be drawn concerning inheritance of flower colour. The data suggested that at least one major gene operating in a polygenic background was responsible for a wide range of colour types in hybrid populations. Leaf shape was determined by a single locus, the allele for palmatifid leaf being incompletely dominant over that for palmate. Evidence was also obtained of a gene affecting lobe width. Plant hairiness was primarily due to control at a single locus, dense hairiness ($H^{A1}$) being recessive to the sparsely hairy condition ($H^{A2}$). The relative amounts of long simple and short stellate hairs on the stem and petiole were under the control of a pair of modifiers, $Su^h$, $su^h$. $Su^h$ resulted in a preponderance of long simple hairs and few or no short stellate ones and $su^h$ in a preponderance of short stellate hairs and few or no long simple ones. The locus is regarded as having a suppressor type of action, controlling the production of a certain substance determining the relative amounts of the two types of hairs.

4116 Rhyne, C. L.
**Linkage studies in *Gossypium*. I. Altered recombination in allotetraploid *G. hirsutum* L. following linkage group transference from related diploid species.**
Genetics 1958 : **43** : 822–34.

Investigations were carried out to determine the relative importance of the influence of chromosomal structural differentiation and genotype upon recombination, using the duplicate linkage groups in genomes $A_h$ and $D_h$ in *G. hirsutum* described by the author in an earlier paper [cf. XXVIII, 718]. No evidence of an effect of the genotype was obtained from appropriate $F_2$ and back crosses. For example, recombination for $Cl_1$–$r_1$ (genome $D_h$) was 14–18% in an intraspecific *G. hirsutum* background, 14·5% in an interspecific strain having both $A_2$ and $D_1$ genes and 15–18% in another interspecific strain carrying $A_h$, $D_h$ and $D_5$ genes. For the linkage $r_1$–$Yg_1$ (genome $D_h$), *G. hirsutum* strains gave recombination values ranging from 14·2 to 28·5%. Interspecific derivatives having $A_h$,$A_b$, $D_h$ and $D_b$ genes had 20–26% recombination for $R_2$–$Yg_2$ and 26–41·7% for $Yg_2$–$Lc_1$ in the $A_h$ linkage. The population sizes were such that the interstrain variation in recombination values for a given linkage could be considered as equivalent to sampling variation in a larger population. The transference of a linkage group from three diploid sources ($D_5$, $D_1$ and $A_2$) to *G. hirsutum* resulted in a significant decrease in recombination within the region $Cl_1$–$r_1$–$Yg_1$ or $R_2$–$Yg_2$–$Lc_1$, compared with the values obtained for the $D_h/D_h$ or $A_h/A_h$ linkage group in similar genotypic backgrounds. The reduction in recombination caused by structural differentiation is explicable by a reduction in chiasma frequency or by a change in the position of the chiasmata.

4117 Turner, J. H.
**Hybrid cotton breeding program.**
Calif. Agric. 1959 : **13** : No. 3 : 3, 15.
Hybrids are not available for commercial use because cross pollination cannot be easily controlled. However tests in 1955 showed that spraying with sodium $\alpha,\beta$-dichloroisobutyrate produces male sterility though some female sterility also occurred. Experimental crosses, involving 15 strains, have been made. The hybrids from these crosses, plus two synthetic hybrids, will be evaluated in 1959.

4118 Iyengar, N. K., Santhanam, V. & Leela, M.
**Further studies in *arboreum-anomalum* crosses.**
Indian Cott. Gr. Rev. 1958 : **12** : 369–75.
Further results in the transference of lint fineness from *Gossypium anomalum* to Karunganni (*G. arboreum*) are given. Fully fertile and fine-linted plants with a good mean fibre length were obtained in both the $F_2$ and $F_3$ from the first and second back cross. In selecting the progeny, an optimum standard for fineness was fixed at a mature fibre weight of about $1{\cdot}50 \times 10^{-6}$ g./cm. and a swollen hair diameter of 20·0 $\mu$. It is expected to build up homozygous lines from the above-mentioned material for further exploitation in order to bring the ginning percentage values to the level of the *G. arboreum* strains. The genetic potentialities of utilizing the different geographical races of *G. arboreum* in crosses with *G. anomalum* should be assessed.

4119 **Indo-American cottons forge ahead.**
Indian Cott. Gr. Rev. 1958 : **12** : 414–15.
Two Indo-American strains, 170–Co.2 and 134–Co.2–M, combine the extra-long staple of the American variety with the hardiness and adaptability of the Asiatic cottons. They also possess a higher resistance to pests and diseases than American varieties. However their spinning capacity is not very high because of the weak fibre and attempts are being made to isolate types with the necessary fibre strength and the required staple length.

4120 Worley, S. (Jun.).
**Inheritance of fiber strength in an interspecific cross of cotton.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–2859 : p. 630. (Abst.).
Inheritance of fibre strength was investigated in the $F_1$–$F_3$ of *Gossypium hirsutum* 'DPL15' x *G. barbadense* 'Sea Island.' Strength was measured by the Pressley tester, utilizing (1) the Pressley index and (2) 0·125 in. strength index. Strength behaved as a quantitative character. Partial dominance of low Pressley index was detected. Index (2) was not affected by dominance. Strength was dependent upon a relatively small number of genes. More genes appeared to be segregating for (2) than for (1). $F_3$ data provided the most reliable basis for estimating heritability and indicated that 50–60% of the $F_2$ plants with high strength gave rise to high-strength $F_3$ lines. Thus selection for strength on an individual-plant basis would be highly effective. Strength was not associated with seed index, lint-density index, lint percentage and "immaturity or shape factor" in the $F_2$ or $F_3$. The correlation coefficient between (1) and (2) in the $F_2$ was 0·74 and between means of $F_3$ lines 0·62. Both $r$ values were highly significant. Several exceptions to this association were however found among the 80 $F_3$ lines. Some were high in (1) but only average to low in (2), while other lines were high in (2) but intermediate to low in (1).

4121 Ferrer-Monge, J. A.
**Inheritance of yield components in an interspecific hybrid of cotton.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7327 : p. 1525. (Abst.).
A genetical study was made of 85 $F_3$ lines derived from *Gossypium hirsutum* 'DPL15' x *G. barbadense* 'Sea Island' and the parental varieties with respect to (1) seed index, (2) lint-density index, (3) lint index and (4) lint percentage. Because of the transgressive inheritance shown by (1), it was concluded that the parents differed by several pairs of genes for this property, although many lines were phenotypically similar to the parents. The parents had lint-density indices of 6·8 and 4·1 g. respectively. No line was recovered with a mean index as high as that of DPL15 and only five lines exceeded the parental average. Thirty-seven lines resembled the Sea Island parent in this index and 24 had appreciably lower means than this variety. The fact that no line equal to DPL15 was recovered suggested that the parents differed by several pairs of genes for (2). The large number of lines equal or inferior to Sea Island was attributed to physiologically unbalanced genotypes. Three lines resembled DPL15 in their means for (3) but none had the high index (2) of this parent (6·8 g.). No line as valuable as DPL15 was therefore obtained. No line had as high a value for (4) as DPL15 (42·9%). The large numbers of lines lower than Sea Island in (3) and (4) are attributed to the high frequency of abnormally low lint density. Heritability values for (1), (2), (3) and (4) were

respectively 59, 64, 73 and 77%. Comparison of the results of selection and no selection for each of the four properties in the $F_2$ indicated that selection in this generation would in each case be highly effective. No association was found between (1) and (2). Indices (3) and (4) were highly correlated with (2) and could be used in selecting for high lint-density.

4122 Koval'čuk, P. I.
**(The shattering of the hereditary properties of cotton by means of hybridization between closely related species followed by pollination of the hybrids thus obtained with the pollen of distantly related species).**
Izv. Akad. Nauk uzbek. SSR (News Acad. Sci. Uzbek SSR) : Ser. biol. 1957 : No. 2 : 15–24; from Ref. Ž. (Ref. J.) 1958 : No. 9 : Abst. 38065 : p. 33. [Russian].

Interspecific incompatibility between cotton cultivars with 26 and 52 chromosomes was overcome by employing $F_1$ hybrids from crosses between the 26-chromosome species *Gossypium herbaceum* and *G. arboreum* as ♀ parents and pollinating them by the 56-chromosome species *G. hirsutum* or *G. barbadense*. Fertile hybrids from such crosses amounted to 14%.

4123 Vysockij, K.
**(Intergeneric hybrids of cotton).**
Hlopkovodstvo (Cotton Growing) 1958 : No. 7 : 29–32. [Russian].

Intergeneric sexual hybridization between cotton cultivars such as Navrockij and Šreder on the one hand and different species of *Althaea, Malva, Hibiscus* and other Malvaceae on the other is reported from the Central Asiatic Branch of the Institute of Plant Industry. The sterility of the $F_1$ was overcome by back crossing to cotton or the other parental species. Some hybrids obtained in this way are characterized by earliness, large bolls or combined resistance to wilt, *Xanthomonas* and *Tetranychus urtica* and many are superior technologically to 108F and other older varieties.

4124 Lewis, C. F.
**Genetic studies of a mosaic leaf mutant.**
J. Hered. 1958 : **49** : 267–71.

A mutant, designated mosaic leaf, was observed in the progeny of a *Gossypium hirsutum* introduction. The multicoloured variegation of the upper surface of affected leaves was the most conspicuous feature of these plants, which were both male and female fertile but relatively unproductive. Data from a cross between the mutant and Deltapine 14 indicated that mosaic leaf is controlled by a stable gene (*ml*), recessive to normal green. In *mlml* plants, changes occurred in the somatic cells which resulted in the erratic occurrence of mosaic areas. The crinkled nature of certain mosaic areas and the irregular shape of some leaves were apparently pleiotropic effects of the *mlml* genotype.

4125 Milkovski, J. & Dragoev, M.
**(The spinning and technological properties of the new cotton varieties).**
Naučn. Trud. (Sci. Trans.) Minist. Zemed., Sofija : Ser. Rastenievădstvo (Pl.-Industr.) : 1958 : **3** : No. 4 : 33–42. [Bulgarian].

The new Bulgarian varieties 1017, 2362, 2367 and the Soviet cultivar S460 had better technological properties than the older varieties 138 and 915 in tests carried out at the Textile Institute of Sofia. In particular they were characterized by longer and thinner fibre, greater breaking length and improved staple length. The gauge numbers for yarns from all the above varieties are given.

4126 **Acala 1517C cotton shines in N. Mex. trials.**
Crops & Soils 1959 : **11** : No. 8 : p. 20.

Acala 1517C has a higher yield than all varieties except Deltapine 15. It has superior fibre quality and is resistant to *Verticillium* wilt.

4127 Sarvella, P.
**Multivalent formation and genetic segregation in some allopolyploid Gossypium hybrids.**
Genetics 1958 : **43** : 601–19.

Information is provided on the behaviour of the chromosomes of a series of 6*n* and 4*n* allopolyploid hybrids. The average numbers of multivalents per pollen mother cell were as follows: 6*n* (*G. hirsutum* x *G. anomalum*), 1·17 ± 0·18; 4*n* (*G. arboreum* or *G. herbaceum* x *G. anomalum*), 1·90 ± 0·10; 6*n* (*G. hirsutum* x *G. thurberi*), 3·61 ± 0·28; 4*n* (*G. thurberi* x *G. raimondii*), 3·94 ± 0·19; 6*n* (*G. hirsutum* x *G. raimondii*) 6·16 ± 0·19; and 4*n* (*G. arboreum* x *G. herbaceum*), 9·42 ± 0·69. Chiasma counts were made using two different methods; one method involved assuming there was a maximum of one half chiasma per chromosome arm and the counts of the other method were based on the appearance of the associations. For some of the hybrids significant differences were found between results from the two methods. A graph was made of expected genetic segregation ratios plotted against the frequencies of

multivalents; it was assumed that all bivalents were the result of homogenetic pairing and that multivalents separated at random. Multivalent frequencies were also plotted against the actual segregation ratios reported by Gerstel [XXVI, 3517] and Gerstel and Phillips [XXVIII, 4445] and confidence limits drawn as rectangles around the points. The relation between multivalent frequency and expected segregation ratio was linear but deviated markedly from the observed values. The 4*n* hybrid *G. arboreum* x *G. herbaceum* had fewer than the expected 13 multivalents. This deviation was probably due to heterogenetic pairing of bivalents. In order to account for this discrepancy, an alternative straight line was drawn connecting the point representing 4*n* *G. arboreum* x *G. herbaceum* with the origin. However 6*n* *G. hirsutum* x *G. raimondii* gave a better fit to the first line than to the second and 6*n* *G. hirsutum* x *G. thurberi* had too great a multivalent frequency to fit either line. Possible causes of these discrepancies are discussed and it is suggested that gametic and zygotic selection may have influenced the segregation ratios. Data from the tetraploids also did not fit either of the graphs. In general there was, however, a relationship between the number of multivalents and the segregation ratios; hybrids of closely related species tended to have more multivalents and more segregation than hybrids of more distantly related species.

4128 Simonguljan, N. G.
**(The role of the pollen of the maternal variety in hybridization).**
Izv. Akad. Nauk uzbek. SSR (News Acad. Sci. Uzbek SSR) : Ser. biol. 1957 : No. 2 : 25–32; from Ref. Ž. (Ref. J.) 1958 : No. 9 : Abst. 38068 : p. 33. [Russian].

The addition of pollen of the maternal parent to that of the main pollinator had a physiologically beneficial effect upon fertilization in *Gossypium hirsutum*. The experiments suggested that fertilization might be multiple.

4129 Pejčev, S. & Zlatev, G.
**(A study of the citric-acid content of the leaves of cotton grown under irrigation, pruned and defoliated).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 251–59. [Bulgarian].

The Soviet variety S460 was the most productive of leaves and had the highest citric acid content out of 7 varieties studied in Bulgaria.

4130 **Getting rid of gossypol.**
Agric. Res., Wash. 1959 : **7** : No. 10 : p. 6.

By crossing a primitive cotton, Hopi Moencopi, in which the number of gossypol glands is variable, with a commercial variety and selecting through several generations, a glandless strain and several strains with a few glands have been produced. [Cf. 4133.] It is not known how easy it will be to combine glandlessness with the disease resistance, quality and yield of lint of commercial varieties. Oil from low-gossypol seed has superior colour and grade and seed meal from these new lines is an excellent protein source for swine and poultry.

4131 Jaroš, N. P.
**(Quantitative variability of gossypol in the seed of cultivated cotton species).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 31–35. [Russian].

Many strains of *Gossypium hirsutum*, *G. barbadense*, *G. herbaceum* and *G. arboreum* grown under irrigation at Taškent were analysed, the aim being to find breeding material with a low gossypol content. Such material was selected from all the above species except *G. barbadense*. *G. hirsutum* varieties with a gossypol content not exceeding 0·76% were found among forms originating from Africa, Armenia, Japan and the USA. *G. arboreum* varieties with only a 0·40% gossypol content occurred among Japanese, North Korean and Indian material. Some Chinese, Tajik and Uzbek strains of *G. herbaceum* had a very low gossypol content, 0·19–0·22%. Considerable heritable variability in gossypol content was observed between different plants of the same strain and it is thought that this can be utilized in selection for reduced gossypol content.

4132 Neelakantan, L. & Palaniappan, K. K.
**Variation in the degree of exsertion of stigma in *arboreum* cottons.**
Indian Cott. Gr. Rev. 1958 : **12** : p. 376.

*Gossypium arboreum* varieties showed variations in the degree of stigmatic exsertion above the top of the anthers at anthesis, ranging from 0 to 9 mm. The mean values were shortest in the collections from Uttar Pradesh and longest in those from Madras. The bolls of varieties with a short-exserted stigma burst earlier than those of varieties with longer exserted stigmas.

4133 Rhyne, C. L., Miller, P. A. & Smith, F. H.
**Low-gossypol cotton.**
Res. & Fmg. 1959 : **17** : No. 3 : p. 14.

Cotton seeds contain as much as 1% to 2% gossypol, which is undesirable. By crossing a strain, originally grown by the Hopi Indians, which is low in gossypol, with locally grown varieties it has been possible to produce lines with a low gossypol content (0 to 0·5%).

4134 **Technological reports on trade varieties of Indian cottons, 1957.**
Technol. Bull. Indian Cott. Comm. : Ser. A. : 1958 : No. 96 : Pp. 97.

The results of the fibre, yarn and spinning tests of 35 varieties are given for 1956–57 and are compared with those of the previous five seasons.

4135 Milkovski, J.
**(Studies of the technological properties of the common cotton varieties in this country).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 23–56. [Bulgarian].

All varieties showed variability in boll size, fibre length and other properties, depending on meteorological conditions. In some varieties, such as the early 915, the quality was also influenced by regional climatic and soil conditions. The new high-yielding variety 2362, from Čirpan, was as early as 915 and surpassed all varieties in the quality of its fibre.

4136 **Progress report on the annual varietal and environmental study of fiber and spinning properties of cottons, 1957 crop.**
US Dep. Agric. 1958 : Pp. 98.

Tables are given indicating the results of tests on new and old commercial varieties and experimental material grown in the USA during 1957.

4137 Bhujang, K. S. & Nanjundayya, C.
**Determination of cotton fibre maturity by dyeing technique.**
J. sci. industr. Res. 1958 : **17B** : 371–76; and Technol. Bull. Indian Cott. Comm. : Ser. B : 1958 : No. 63 : Pp. 6.

A technique is described for the qualitative and quantitative estimation of fibre maturity by means of absorption of carbola violet 2RS. Since a single dye is used, the quantity of dye taken up by a known weight of cotton can be easily estimated and correlated with the degree of maturity. The maturity of 33 commercial cottons belonging to *Gossypium arboreum*, *G. herbaceum* and *G. hirsutum* has been successfully determined by this method, which is considered to be suitable for use by breeders.

4138 Bird, L. S. & Hadley, H. H.
**A statistical study of the inheritance of Stoneville 20 resistance to the bacterial blight disease of cotton in the presence of *Xanthomonas malvacearum* races 1 and 2.**
Genetics 1958 : **43** : 750–67.

Four varieties of *G. hirsutum* were used in this study. The resistant variety Stoneville 20 was crossed with Deltapine which is highly tolerant, Stoneville 2B which has low tolerance and the susceptible variety Acala. The parents and the $F_1$, $F_2$, $F_3$ and back-cross progenies were inoculated with both races 1 and 2 of *X. malvacearum* and graded according to their reaction; the results of the tests were analysed statistically. Also tests were made using the two races of *X. malvacearum* separately; it was then found that Stoneville 20 was highly resistant to race 1 but only slightly resistant to race 2. In one $F_2$ population of the cross Stoneville 20 x Stoneville 2B, some plants were resistant to race 1 but susceptible to race 2 and some were resistant to race 2 but susceptible to race 1; also some of the $F_2$ plants were resistant to both races. The results of the cross Stoneville 20 x Deltapine indicated that resistance was dominant; those of the cross Stoneville 20 x Stoneville 2B did not indicate dominance, and those of Stoneville 20 x Acala suggested that resistance is recessive. When the data were analysed statistically, there was no evidence of dominance. Total phenotypic variance was partitioned into fixable genetic, nonfixable genetic and nonheritable components; of these only that due to fixable or additive genetic variation was highly significant.

Stoneville 20 appeared to have two effective genetic components determining resistance; one is the major gene $B_7$ and the other a constellation of minor genes designated $B_{Sm}$. Stoneville 2B and Deltapine also have an effective component whilst Acala has no effective component. Deltapine and Stoneville 2B carry the composite components $B_{Dm}$ and $B_{Sm}$ respectively; these composite components have some genes in common. It is thought that the varieties have the following genotypes: Stoneville 20, $B_7B_7$ $B_{Sm}B_{Sm}b_{Dm}b_{Dm}$; Deltapine, $b_7b_7b_{Sm}b_{Sm}B_{Dm}B_{Dm}$; Stoneville 2B, $b_7b_7B_{Sm}B_{Sm}b_{Dm}b_{Dm}$ and Acala, $b_7b_7b_{Sm}b_{Sm}b_{Dm}b_{Dm}$. The Stoneville 20 and Stoneville 2B composite components are probably not identical. The genes are additive and the effect of one major gene ($B_7b_7$) is thought

to be greater and less influenced by environment in the presence of two $B_{-m}$ of the composite components than in the presence of one. There was no evidence of linkage between factors controlling Stoneville 20 resistance. The heritability of resistance was estimated as about 45–50%.

4139 Bird, L. S. & Joham, H. E.
**The influence of nitrogen source and carbohydrate change by debudding and girdling on bacterial blight resistance caused by the $B_7$ gene in cotton.**
Plant Dis. Reptr. 1959 : **43** : 86–89.

The influence of environmental factors on resistance of cotton strain E4–2–2–13 to *Xanthomonas malvacearum* has been investigated in the presence of races 1 and 2 of the pathogen. Debudding, which maintains vegetative growth and raises carbohydrate level, increases susceptibility while plants with the main stem girdled become resistant. Nitrogen fertilizers, particularly in the form of nitrates, also increase resistance.

4140 Duffield, P. C.
**Biology of *Puccinia stakmanii*.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–2993 : p. 419. (Abst.).

Tests conducted on different species of cotton for resistance to *Puccinia stakmanii* showed that *Gossypium hirsutum, G. barbadense* and *G. klotzschianum* were highly susceptible, *G. aridum, G. davidsonii, G. armourianum* and *G. stocksii* were susceptible and *G. arboreum, G. herbaceum, G. raimondii, G. gossypioides, G. anomalum* and *G. thurberi* were resistant.

4141 Staffeldt, E. E.
***Thielaviopsis basicola*, a part of the cotton (*Gossypium hirsutum*) seedling disease complex in New Mexico.**
Plant Dis. Reptr. 1959 : **43** : 506–08.

Observations on a large number of genetic lines showed only slight differences in severity of infection by *T. basicola*. All were susceptible in the seedling stage and all recovered at a later stage.

4142 Vojtenok, F.
**(Varietal differences of cotton in resistance to *Verticillium* wilt).**
Hlopkovodstvo (Cotton Growing) 1958 : No. 8 : 32–34. [Russian].

Resistance trials of many varieties infected by *Verticillium* strains of different degrees of virulence at the Central Breeding Station of the USSR Cotton Institute are reported. No wholly resistant varieties were found, but in some the percentages of diseased plants and of those severely affected were considerably lower and the yield correspondingly higher. The resistant varieties include the midseason type 108F and early cottons such as Oš11, 147F, KK2056 and S3506. All these and several others are recommended as initial material for resistance breeding.

4143 Pontoppidan, H.
Forsøg med spindhør ved Taastrup hørskætteri 1955. **(Field trials with fibre flax at Taastrup Flax Mill, 1955).**
Lin 1956 : **10** : 4–12.

In the above two Danish trials, the first including three varieties and the second two additional varieties, Wiera gave the highest yield of scutched flax.

4144 Vezelvlas, 1959. **(Flax, 1959).**
Landbouwvoorlichting **16** : Bijl. 45; Ber. Rassenkeuze 1959 : No. 262 : Pp. 3.

Data on the performance of six established varieties tested in different areas in the Netherlands are presented. Four new selections have undergone preliminary testing.

4145 Šimans'kij, M. K.
**(Intervarietal crossing of flax without emasculation of the flowers).**
Dopov. Akad. Nauk. Ukrajin. RSR (Proc. Ukrain. Acad. Sci.) 1958 : No. 5 : 569–72. [Ukrainian].

Crosses using the above method have been carried out at Odessa between several sets of varieties differing in flowering and maturation dates, plant height, 1000-seed weight, oil content and flower colour and data showing the differences between the parental forms and their progeny in these respects are presented. The experiments are intended to show that hybrid seed can be obtained without emasculating the ♀ parent.

4146 **Seed bulletin. Fibre flax.**
IVRO, Wageningen 1957 : Pp. 7.

Ten varieties grown in the Netherlands are described and data on their yields and agronomic characteristics presented.

4147 Masuo, Y.
**(On natural crossing in flax).**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 321–23. [Japanese].

The extent of natural cross pollination in Hokkaido was determined in a mixed culture of blue and white-flowered varieties. Capsule set in uncaged plots of the blue-flowered variety

averaged 34·3%; the corresponding value for the white-flowered variety was 34·7%. When insect visitors were excluded by caging, the respective values dropped to 8·9 and 3·8%.

4148 Schwinghamer, E. A.
**The relation between radiation dose and the frequency of mutations for pathogenicity in *Melampsora lini*.**
Phytopathology 1959 : **49** : 260–69.

Uredospores of *M. lini* were irradiated in a study of the frequency of induced mutations from dominant avirulence to recessive virulence at the $A_M a_M$ locus for pathogenicity. Mutations at this locus were identified by their ability to infect the immune flax variety Dakota. Evidence of a saturation effect in the mutation rate was noted at high lethality levels for all of the radiations used. The mutation frequency below this level was proportional to the dose in ultraviolet radiation experiments, and nearly proportional to dose in neutron treatments. In X-ray or $\gamma$-ray experiments the frequency varied approximately as the square of the dose. A comparison of these results with similar analyses of chromosome aberrations in higher plants suggests that the mutations induced by the ionizing radiations were predominantly of the deletion type, involving loss of a chromosome segment bearing $A_M$. More localized point changes were induced by ultraviolet rays. An increase in spore water content during irradiation resulted in a sharp increase in the frequency of mutations induced by X or $\gamma$ rays. Fast neutrons were more efficient mutagens than X rays on the basis of equivalent energy absorption in the tissue.

4149 Hoffmann, G. M.
Untersuchungen über die physiologische Spezialisierung von *Colletotrichum lini* (Westerd.) Tochinai. [**Investigations on the physiological specialization of *C. lini* (Westerd.) Tochinai**].
Z. Pflanzenz. 1959 : **41** : 72–88.

Studies carried out at Aschersleben with single-spore lines of *C. lini* from 52 different sources revealed the existence of four morphological races which were most easily recognized when grown on biomalt agar. These races remained constant through several generations of clones and did not change after passage through susceptible and resistant flax.
Eight physiological races of *C. lini* were recognized using five of Schwinghamers' collection of differential flax varieties, the unreliable variety CI1016 being omitted from the tests [cf. XXV, 2223]. Race 8 was the commonest race; it attacked all the test varieties.
A large number of varieties, strains and breeding lines of flax were tested for resistance to races 8 and 12. The Dutch variety Bella and Türkische Leinsaat Mahsuli 511 [Turkish linseed Mahsuli 511] were resistant to both races and also to five others. It is suggested that Bella be used as a differential variety.

4150 Jaranowska, B.
Doświadczenia odmianowe z konopiami przeprowadzone w latach 1951–1953. (**Varietal trials of hemp conducted in the years 1951-1953**).
Roczn. Nauk rol. : Ser. A. : 1958 : **78** : 219–68.

In trials conducted at 14 localities in Poland, the 8 varieties tested fell into the 3 groups northern, southern and central European, within each of which intervarietal differences were slight. Southern varieties, of which the Hungarian was the best, gave higher straw and fibre yields than the others, while the Polish varieties appeared to be better able to withstand unfavourable conditions.

4151 Bonvicini, M.
La canapa. Il miglioramento genetico. (**Hemp. Genetic improvement**).
Agricoltura, Roma 1959 : **8** : 62–64.

Trials are being made in Italy with monecious strains and strains that ripen simultaneously; also with $F_1$ hybrids between German strains with high fibre content and the Italian Carmagnola type, superior in fibre quality.

4152 Albertario, P.
La canapa. (**Hemp**).
G. Agric. 1959 : **69** : p. 179.

In discussing the marked diminution in the amount of hemp grown in Italy in recent years and possible solutions for the crisis, reference is made to some new varieties produced by breeding; in recent trials they have given yield increases of 30–40%.

4153 Sustrina, V. Ė.
(**The effect of external conditions upon sex ratios in the fields of hemp**).
Agrobiologija (Agrobiology) 1958 : No. 4 : 130–32. [Russian].

Various seed treatments which shifted the ratios of ♀ plants : ♂ plants at the Penza Agricultural Institute are described. The proportion of plants with ♀ flowers rose particularly after

soaking the seed in extracts of ♀ inflorescences, increased proportions of ♀ plants being observed also after soaking the seed in solutions of various concentrations of $NH_4NO_3$, $Ca(H_2PO_4)_2$ or KCl.

4154 **Annual Report of the Jute Agricultural Research Institute (1956-57).** Indian cent. Jute Comm. 1958 : Pp. 121.

**Jute.** Indigenous collections of *Corchorus olitorius* and *C. capsularis* and some foreign introductions were selected. Progeny-row tests of both species were carried out. Varietal trials were conducted at the Institute and on cultivators' plots. Colchicine-induced polyploids of *C. olitorius* and *C. capsularis* were selected. Study of morphological aberrants and early variants arising in X-irradiated material continued. Crumpled leaf in *C. olitorius* was recessive to normal and dependent on a single gene. Crosses between *C. capsularis* and *C. olitorius* at the diploid and polyploid levels and in polyploid x diploid combinations were attempted, as well as crosses of *C. capsularis* with *C. estuans* (*C. acutangulus*) and *C. tridens*. In progenies from a cross between the colchicine-induced tetraploid of *C. olitorius* 'CG' and the parental strain, $2n$ ranged from 20 to 35. Physiological investigations included tests of salt tolerance and study of variation in growth components with reference to fibre production. *C. capsularis*, particularly JRC212, again showed more salt tolerance than *C. olitorius*. Analysis of data on varieties of the two cultivated species at the bud and capsule stages revealed the importance of bark weight as a third criterion of selection for fibre weight in addition to plant height and basal diameter. In breeding for resistance to diseases in *C. capsularis*, JRC–918 and a "green-dark-red pigmented type" have been used as highly resistant parents in crosses with improved strains. *C. olitorius* and *C. capsularis*, including X-irradiated and polyploid material, were selected for resistance to *Apion corchori*.

***Urena.*** Mitosis and meiosis were studied in *U. lobata* and *U. sinuata*. Both species had $2n = 28$ and regular meiosis. Crosses were effected to combine the nonhairiness of the stem of the former species with the higher fibre percentage of the latter.

***Hibiscus.*** Secondary selections of *H. cannabinus* and *H. sabdariffa* were made. Study of direct hybrids and back crosses of *H. radiatus* x *H. cannabinus* and of the inheritance of anthocyanin pigmentation in *H. sabdariffa* and *H. cannabinus* continued. Selections from this cross fairly resistant to diseases were carried forward. Red stigma in *H. cannabinus* showed dominance over white and monogenic inheritance (*R*). Divided leaf in this species was dominant over the entire type and dependent on a single factor (*D*). $F_1$ and $F_2$ hybrids of *H. radiatus* x *H. cannabinus* were subjected to cytological analysis. Pollen-tube behaviour revealed no stylar incompatibility in crosses involving *H. cannabinus*, *H. sabdariffa* and *H. radiatus*. Stylar incompatibility was however detected between *H. lunariifolius*, *H. pandurae-formis* and *H. vitifolius*, as well as in crosses between these species and the three first-mentioned.

4155 Kantorovič, A. **(Notes on jute and kenaf).** Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : **8** : 50–53.

This article, discussing introduction, cultivation and breeding of jute and kenaf at the Central Asiatic Research Station of the Institute of Plant Industry, refers briefly to improved new varieties of these plants. The new jute cultivars Uzbek 57 and Taškent 75 are more productive of stems and fibre than the standard variety Pervenec Uzbekistana [Uzbekistan First-born] and superior to it in technological properties. The kenaf varieties 1395 and 1407 will shortly become available on farms. They yield 15–16% more stem and 25–30% more fibre than the older variety 3876 and their fibre extraction rate is higher, 18·5–19·5% as against 16% in 3876.

4156 Tu, D.-S. [T.-S.], Long [Liang], S.-K. & Tuan, S.-L. **(Hua-pe-ta-ching-kan, a superior variety of *Abutilon avicennae*).** Nung-yeh-hsueh Pao (J. Agric.)/Act. agric. sin. 1958 : **9** : 284–90. [Chinese].

The variety Hua-pe-ta-ching-kan [North China Large Green-stemmed] was bred from a form discovered on a farm in Anhwei. It is a late variety with a fibre yield much in excess of that of varieties commonly grown in China.

4157 **Annual Report for the year 1957 of the Tanganyika Sisal Growers' Association, Sisal Research Station, Mlingano, Ngomeni** : Pp. 31.

Three trials of selected *Agave* hybrids in comparison with *A. sisalana* are still in progress. Few of the selections have shown superiority over sisal. Seedlings are being raised from crosses between $F_1$ or $F_2$ hybrids of *A. angustifolia* x *A. amaniensis*.

## SUGAR AND STARCH PLANTS

4158 **Sugarcane research in India: 1929-1954—a review. II. Sugarcane botany and breeding; soils.**
Indian J. Sugarcane Res. Developm. 1958 : **3** : 43–57.

Research on the taxonomy, morphology and anatomy of the cane, breeding techniques, and cytogenetics of *Saccharum* species, interspecific and intergeneric hybrids, is summarized. Commercial varieties produced at the Indian Research Station are briefly described.

Congrès Sucrier 1958. (**Sugar Congress, 1958**).
Rev. agric. sucr. Maurice 1958 : **37** : Pp. 366.

4159 *Wiehe, P. O. Le problème des variétés de cannes à Maurice.* (*The problem of sugar-cane varieties in Mauritius*). (*pp. 194–201*).

The succession of varieties cultivated in Mauritius during the past 125 years and factors responsible for the changes are reviewed. Also a brief account is provided of the breeding scheme being used at present.

4160 *Hugot, E. Critère et formule de comparaison entre champs, parcelles, variétés ou traitement de cannes.* (*A criterion and formula for comparison between fields, plots, varieties or treatment of canes*). (*pp. 212–16*).

In assessing the merits of different varieties of sugar cane, fertilizer treatments and other variables, the criterion hitherto used has been the weight of sugar obtained per unit area. However it is thought that the expenditure incurred in raising the crop and obtaining the sugar should be considered and a formula has been developed by means of which the net profit from the different treatments can be compared.

4161 *Sornay, A. de. Resistance of sugarcane varieties to cyclones.* (*pp. 241–51*).

During 1958 Mauritius was visited by two cyclones, after which the damage experienced by different varieties was assessed. The three most resistant varieties were B3347, M147/44 and B37172. B3337 is capable of maintaining its stalks erect under a high wind; this may be due to its high fibre content. The possibilities of breeding for cyclone resistance are discussed and suggestions made for future investigations.

4162 *Rouillard, G. L'expérimentation aux champs à l'Institut de Recherches Sucrières.* (*The field experimentation at the Sugar Research Institute*). (*pp. 252–58*).

A brief mention is made of the varietal trials carried out in Mauritius.

4163 Méndez Roig, F. & Samuels, G.
Experimentos con variedades de caña de azúcar en Puerto Rico, 1951–1955. (**Experiments with sugar-cane varieties in Puerto Rico, 1951-1955**).
Bol. Estac. exp. agríc. PR 1958 : No. 144 : Pp. 37.

At each of 19 localities, 25 varieties were tested, most of them new but some of them commercial varieties serving as standards. Data on the sugar yield per acre, cane yield per acre and sucrose content of the canes are given for the seven best varieties in each area together with the data for one or more of the standards. PR980 was best in sugar yield in the north-western, western, southern and central areas, B4010J in the north central region, H328560 in the north-east and B37172 in the east. PR975 and B4362 were highest in sugar content.

4164 Méndez-Roig, F., Samuels, G. & Colón, A.
**Sugarcane variety trials in Puerto Rico, 1952-57.**
J. Agric. Univ. PR 1959 : **43** : 1–18.

The results of trials conducted at the Agricultural Experiment Station of the University of Puerto Rico, Río Piedras, are reported. Most of the varieties tested were developed at the station.

**Sugar Bulletin of the Department of Agriculture, British Guiana 1956** : No. 24 : Pp. 101.

4165 *Birkett, L. S. & Cameron, C. Field experiments with sugar cane, XXIV.* (*pp. 1–45*).

Details are given of the tons of cane per acre pol. %, purity and sucrose in cane per acre, for cane varieties in 1955.

4166 *Birkett, L. S. The variety and fertilizer position of the sugar industry, XXI.* (*pp. 81–87*).

B41227 was the chief variety grown and B37161 was the second major variety grown in 1955. Of the newer varieties, B47225 has come into

sudden prominence, though B47258 is the most promising new variety.

4167 *Birkett, L. S. Report on the sugar experiment stations for the year 1955.* (*pp. 89–95*).

Introduced material is listed. The variety trials carried out are reported above.

4168 *Pires, J. A. The history of leaf scald in British Guiana*, 1950–1956. (*pp. 97–101*).

A table is included giving the ratings of a large number of Barbados, Demerara, breeding and other canes for reaction to leaf scald (*Xanthomonas albilineans*).

**Sugar Bulletin of the Department of Agriculture, British Guiana 1958** : No. 26 : Pp. 95.

4169 *Field experiments with sugar cane, XXVI.* (*pp. 1–55*).

Details are given of the tons of cane per acre, pol. %, purity and yield of sucrose for cane varieties in 1957. On the basis of these results B41227, B37161, B47258, B45137, B43413, B46378, B4362 and D141/46 are recommended.

4170 *Birkett, L. S. The variety and fertilizer position of the sugar industry, XXIII.* (*pp. 77–88*).

B37161 continued to be the major variety, 43·1% of the acreage reaped being of this variety. B41227 remains the second major variety, with 32% of the acreage reaped. B47258 and B46378 continued to give good average yields. B4098, B47225 and Pindar are of less importance.

4171 *Pires, J. A. Leaf scald ratings of sugar cane varieties in British Guiana.* (*p. 95*).

Ratings of commercial cane varieties tested for resistance to leaf scald (*Xanthomonas albilineans*) are tabulated.

4172 Kandasami, P. A. & Subba Rao, K. S.
**Inheritance of fourth glume in certain *Saccharum* hybrids.**
Curr. Sci. 1959 : **28** : 208–09.

$F_1$ data on *S. officinarum* x *Sclerostachya fusca*, *S. officinarum* x *Narenga*, *S. robustum* x *Sclerostachya fusca*, *S. robustum* x *Narenga* and *S. officinarum* x *Erianthus ciliaris* indicated that lack of the fourth glume in the two *Saccharum* species was recessive to the presence of this glume in the other parents.

4173 Khanna, K. L., Sharma, S. L. & Shrivastava, R. C.
**Outstanding canes of Bihar: III—B.O. 11; a high-sucrose cane.**
Indian J. Sugarcane Res. Developm. 1958 : 33–39.

The above variety is a mid-early cane, bred from Co.311 x POJ28780 by the Sugarcane Research Institute, Pusa, Bihar. It has replaced earlier varieties in Bihar because of its high sugar content and yield. It has a good tillering capacity, a good stand, a fair ratooning capacity, is moderately resistant to drought, waterlogging and flooding and is fairly resistant to smut (*Ustilago scitaminea*), although it is susceptible to *usar*, borers, white fly, *Pyrilla* and red rot (*Physalospora tucumanensis*).

4174 Fors, A. L.
La variedad Cuba 693–47. (**The variety Cuba 693-47**).
Bol. Asoc. Téc. azuc. Cuba 1959 : **18** : 95–99.

The sugar cane Cuba 693–47 was developed at the Agronomic Station of Santiago de las Vegas from a cross between POJ2878 ♀ and C15792 ♂. Its germination is rapid, its habit recumbent and its tillering profuse, so that the ground is rapidly covered both by the first year plants and by the ratoons. It has so far appeared resistant to mosaic, ratoon stunting, borer and other disorders. It is of medium maturity and has proved superior to other commercial varieties on a wide variety of soils.

4175 Cross, W. E.
**The "San Pablo" seedling varieties of Tucuman.**
Int. Sug. J. 1959 : **61** : No. 724 : 99–100.

The San Pablo varieties of sugar cane were produced during 1948–1950 at the Experimental Farm of the Tucumán Sugar Factories. A brief report is now presented on the origin of these varieties and on the general performance and characteristics of the most promising varieties. Some of these are vigorous, productive and resistant to diseases. For example San Pablo 46 is practically immune to smut and top rot, tolerant of mosaic and fairly resistant to frost. It can be cultivated as stubble cane for many years, maintaining its high productivity.

4176 Aala, F. T.
**Phil 49-22, a promising cane hybrid.**
Sug. News 1957 : **33** : 591–93.

The above variety is a hybrid of Trojan x Alunan (LC25/191). It exceeds the locally

grown Philippine variety Alunan both in yield of cane and sugar and in resistance to Fiji disease.

4177 Fors, A. L.
¿Afecta el tratamiento prolongado del agua caliente (TPAC) la floración de la caña? (**Does prolonged hot-water treatment affect the flowering of sugar cane ?**).
Bol. Asoc. Téc. azuc. Cuba 1958 : **17** : 857–60.

The opinions of various workers on the effects of the hot-water treatment used against ratoon stunting are cited. G. C. Stevenson of Barbados notes that the treatment increases the percentage of flowering in B37161 and B41211 but does not increase yields. Stimulation of flowering by hot-water treatment in varieties which have not flowered for many years in Florida is reported by C. O. Grassl. J. H. Buzacott suggests that in the above cases the ratoon stunting disease inhibits flowering and that the apparent stimulation of flowering by treatment is due to removal of the inhibitory effect. He states that in Queensland the treatment has had no influence on flowering except occasionally a depressive effect.

4178 Price, S.
**Critique on apomixis in sugarcane.**
Econ. Bot. 1959 : **13** : 67–74.

Certain forms of apomixis may occur in *Saccharum*, but they probably do so very infrequently for no progeny or individual seedling has been adequately demonstrated to be derived from any of the apomictic processes. The production of seedlings under conditions which exclude all possibilities of contamination and self or cross pollination is needed to provide evidence of apomixis.

4179 Hebert, L. P. & Henderson, M. T.
**Breeding behavior of certain agronomic characters in progenies of sugarcane at the United States sugarcane field station, Houma, La.**
Tech. Bull. US Dep. Agric. 1959 : No. 1194 : Pp. 54.

The progenies of 11 crosses were used in these studies and the performance of single stools was compared with that of clones derived from these stools. It was found that 40–60% of the single stools selected for large stalk diameter produced clones having large stalk diameter but selection for erectness of stalk and for number of stalks per stool was not so effective. Also in respect of erectness and number of stalks the effectiveness of selection varied between different crosses. Selection for these characters should be based on results from several crops of the clones. Measurements of Brix were made in the field using a refractometer; the correlation coefficients between the Brix values of single stools and of clones derived from them were significant but differed widely in magnitude between crosses, indicating that selection for Brix among single stools would be far more effective in some crosses than in others. However it is thought that in any single season selection among clones for Brix as measured by the hydrometer under laboratory conditions and sucrose as determined by polarization would be very effective.

Among 869 single stools of the crosses studied, 17% had the minimum requirements of commercial varieties in respect of stalk diameter, erectness, number of stalks per stool and Brix. If selection had taken place, 31% would have produced clones with the minimum requirements. Thus selection among single stools for the four characters together would be of value. A breeding programme for the development of varieties for Louisiana is suggested. This involves growing 80,000 to 100,000 seedlings and selection standards are lowered so that 1000 single stools can be selected per year.

No association was found between stalk diameter on the one hand and erectness of stalks, number of stalks per stool, Brix and sucrose on the other. Erectness was not associated with number of stalks, Brix and sucrose and also there was no association between number of stalks per stool on the one hand and Brix and sucrose on the other.

On the whole parents with large stalk diameter had progenies with large stalk diameter but many individual stools had stalk diameters larger or smaller than either parent. Progenies from crosses between erect parents were usually erect and the average ranking of progenies in respect of this character was similar to the average ranking of the two parents in each case. Progenies also resembled the parents in the number of stalks per stool and in Brix but there was a considerable amount of transgressive segregation for Brix in all seven crosses. It is concluded that the general performance of cross progenies can be predicted with some degree of accuracy from the performance of the parents.

4180 Thomson, G. M.
**Sugarcane disease testing methods in Natal.**
Proc. 32nd Annu. Congr. S. Afr. Sug. Tech. Ass. 1958 : 104–11.

An account of the general methods used in

testing new varieties for disease reactions is followed by information on the procedures employed in trials of susceptibility to mosaic, streak, smut, red rot, gumming disease and ratoon stunting and of tolerance to ratoon stunting and mosaic. Suceptibility to the first three diseases is determined in a single experiment.

4181 **Annual Report of the Sugarcane Breeding Institute, Coimbatore for 1955-56.** Pp. 114.

Crosses have been made between canes of known breeding value, new promising varieties and foreign canes. Other crosses were effected to evolve disease-resistant types, chewing types and canes combining high yield and sugar content. Information is given on the parentage and other characteristics of Co.1152 to Co.1171 released in 1956. The selections include early-maturing types rich in sugar, as well as some resistant to the major diseases. Varieties Co.658 and Co.678 have continued to outyield Co.419, the dominant variety in the tropical area. Co.775 has proved a high-yielding and high-quality cane.

Further study of the interrelationship between *Saccharum officinarum* and *S. spontaneum* has continued. Cytomorphological investigation of ten seedlings from back crosses of P1015/1 ($2n = 70$) with *S. spontaneum* ($2n = 64$) revealed that in certain of the seedlings all the *S. officinarum* chromosomes had been eliminated, while in others there were three or five *S. officinarum* univalents. Whenever *S. officinarum* chromosomes were present the seedlings had thicker stalks and better Brix readings compared to those without *S. officinarum* chromosomes. All the seedlings proved fertile.

*S. officinarum* and *S. robustum* were crossed together in an attempt to understand the relationship between them and to introduce hardiness and vigour into the progeny. Data on the tillering and morphology of the progeny are given. Intergeneric crosses were effected with *S. officinarum* 'Kajla' as the female parent and *Sclerostachya* and *Narenga* as male parents. The third backcross progeny of *S. officinarum* 'Vellai' x *Sclerostachya* were crossed with *Sorghum durra*. Certain of the morphological characters of the hybrids indicate the influence of *Sorghum*. Co.421 is male sterile, though meiosis is regular. It does not appear to be a suitable female parent for evolving thick types of commercial canes as it produces a high number of thin seedlings as a result of chromosome elimination during the formation of the ♀ gametes.

With the completion of the collection of *S. spontaneum*, other *Saccharum* species and related genera in India, the survey was extended to neighbouring countries. Results of the study of the formation of rhizomes, floral characteristics, flowering, starch content of the stem and resistance to diseases of different variants of *S. spontaneum* are given. The chromosome numbers of 35 *S. spontaneum* variants ranged from $n = 30$ to 64 and those of related genera from $n = 10$ to 30. Twenty-five crosses were made with variants of *S. spontaneum* in order to evaluate their breeding behaviour. It appears that the possibility of inbreeding and selection for high sucrose content in *S. spontaneum* is worth pursuing. Results of tests for juice quality of *S. spontaneum* variants and seedlings at different stages of nobilization and seedlings from other crosses are given.

The results of investigations on the influence of day length and change from one photoperiod to another in different varieties are reported.

Seedling varieties, varieties in cultivation, *S. spontaneum* variants, hybrid seedlings and other *Saccharum* species were tested for resistance to red rot (*Physalospora tucumanensis*) by inoculation with strain 244. The variety Co.213 was used as standard. The experimental study of the spread of the disease in relation to age of the cane revealed that inoculation of young stalks can be relied upon for comparison of the resistance of the varieties. As different strains of the fungus react differently on the same cane variety the testing programme should be carried out with as many virulent strains as possible. Co.349, Co.421, Co.453, Co.622, Co.835, Co.S245, BO10 and HM645 proved to be resistant. Of 214 *S. spontaneum* variants inoculated, 100 were resistant. In this species the infection was found to be capable of passing into and spreading through underground rhizomes.

Seedlings were also tested for resistance to smut (*Ustilago scitaminea*). Co.475, which was used as a standard, gave 60% infection. Work on *Cephalosporium sacchari*, mosaic, rusts and minor diseases is continuing. Six of the varieties tested during the year for resistance to *Scirpophaga nivella* showed over 50% of infection and 904 varieties were free from attack. Thick varieties were more severely attacked than thin varieties. The incidence of *Chilotraea infuscatellus* was below 25% in most varieties and was more common in thin than thick varieties. Humid conditions are most favourable for the attack of *Proceros indicus*, which is recorded most frequently on thick varieties. Pest incidence was also recorded on *S. spontaneum* variants.

The work at the sugar cane substation at Karnal is summarized. Co.617, Co.622, Co.661, Co.919, Co.927, Co.928, Co.844 and Co.1093 proved to be some of the most resistant varieties to *Scirpophaga nivella*. The varieties Co.853, Co.979, Co.1029, Co.1135 and Co.1145 show good vigour and tillering.

4182 **Thirteenth Annual Report of the Indian Central Sugarcane Committee 1956-57** (1958) : Pp. 156.

At Coimbatore, varieties which possess good breeding qualities, such as Co.617, Co.678, Co.798, Co.935, Co.853, Co.944 and Co.961, have been used in bulk and semi-bulk crosses. Some promising exotic varieties have also been utilized, of which CP 49/50, M63/39, Q49 and Q50 may be mentioned. The probable role of *Erianthus maximus* and *Saccharum robustum* in the speciation of *S. officinarum* and the breeding behaviour of Co.602 when crossed with *S. spontaneum* ($2n = 64$) and *S. robustum* ($2n = 64$) have been studied. The progeny of Co.602 x *S. spontaneum* showed markedly the pollen parent characters, but *S. robustum* characters did not appear so strongly in the progeny of Co.602 x *S. robustum*.

Taxonomical studies of *S. spontaneum* have shown that spikelet length is partly related to the geographical distribution of the variants; nine geographical areas have been distinguished on the basis of broad differences in spikelet lengths. Chromosome numbers of 67 more variants of *S. spontaneum* were determined. New chromosome numbers were found to occur in certain areas where they had not been met with before. Selfs and crosses of selected chromosome types were effected for pursuing genetical studies and to assess the breeding value of *S. spontaneum*. Confirmation of the general effectiveness of 4 hours of extra darkness in hastening floral initiation has been obtained. Resistance to red rot (*Physalospora tucumanensis*), smut (*Ustilago scitaminea*) and insect pests has continued to be studied in different varieties at Coimbatore and elsewhere. Varietal trials have been carried out in different states and several new canes have been released.

4183 Vasudeva, R. S., Iyengar, M. R. S., Bajaj, B. S. & Chatrath, M. S.
**Mutation in *Colletotrichum falcatum* Went, the causal organism of red rot of sugarcane. I. Induced by beta radiation.**
Indian Phytopath. 1958 : **11** : 91–95.

A stable mutant of *C. falcatum* (*Physalospora tucumanensis*) was induced as the result of growing the pathogen in a liquid medium containing $P^{32}$ with an initial activity of about 240 $\mu$c/ml. The mutant resembled the nonvirulent type with dark-coloured mycelium and reduced sporulation. Its spores did not have the falcate shape characteristic of this fungus and were smaller and more variable in shape than the normal type.

4184 Willey, L. A.
**Sugar beet trials, 1951-57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 358–63.

Field trials of 23 British and foreign varieties at nine centres were completed during the above period. Data are presented on percentage of bolting, yields of roots, sugar and tops, sugar content, noxious N and juice purity. Results from the main trials showed Battle's N and N2, Bush N and Johnson's N (new stock) to be similar in performance to the control, Sharpe's Klein E. The value of breeding within the environment in which the varieties are to be grown was brought out, since material from Denmark, where the environment is not markedly dissimilar from that in the United Kingdom, gave better results than, for example, Hungarian varieties, which had been selected under more widely dissimilar conditions.

Sborník cukrovarnicko-řepařské konference v Praze 14.–19 X. 1955. (**Papers of the conference for sugar beet in Prague, 14-19 October 1955**) 1957 : I & II : Pp. 1123.

4185 *Mazlumov, A. L.* (*Sugar-beet breeding and seed production in the USSR*). (*pp. 91–114*). [*Russian*].

The organization of sugar-beet breeding and seed production in the USSR is outlined and mention is made of the *Cercospora*-resistant beet Pervomajskij P028, the mildew-resistant variety Kirgizskij K018 and some monogerm forms developed at the Belaja Cerkov' and Jaltuškov stations and equalling the corresponding standard types in yield and sugar content.

4186 *Filutowicz, A. Kierunki selekcji cytologicznej odmian poliploidalnych.* (*Directions in cytological selection in polyploid varieties*). (*pp. 115–24*).

Determination of percentage crossing of polyploid beets with diploids could be readily effected if the polyploids had the constitution *rrrr gggg*, giving unpigmented hypocotyls, and the diploids *RR gg*, giving red hypocotyls. Crosses between homozygous coloured and homozygous unpigmented lines gave heterotic

hybrids [cf. XXVII, 2072]. Studies of $C_0$, $C_2$, $C_4$ and $C_6$ generations of tetraploid beets showed that bivalent formation was increasingly regular, pollen fertility higher and percentage of abnormal tetrads lower in the later generations.

4187 *Stehlík, V. Studie genetických a agrotechnických vlivů na technologickou hodnotu cukrovky a jejich využití šlechtění.* (*A study of genetical and agrotechnical influences on the technological value of the sugar beet and their exploitation in breeding*). (*pp. 125–40*).

A mention is made of work carried out at Semčice, where attempts have been made to improve existing superior varieties. For many years the effect of selection on technological properties has been studied. Crosses of *Beta vulgaris* var. *maritima* and *B. trigyna* with sugar beet have been studied; the material was rather variable with respect to the digestion values which ranged between 17 and 22% for families from the same experimental field. Crosses between Dobrovice varieties and foreign varieties were also effected and the effects of heterosis and different parental combinations investigated. Some lines of high sugar content and low soluble ash and amide nitrogen content have been selected.

The varieties Dobrovice C and Zapotil C are mentioned as being particularly suitable for cultivation with a high level of manuring. Attention has also been paid to breeding for resistance to drought, *Cercospora* and viruses.

4188 *Stehlík, V. Novodobé obdělávání cukrovky a jeho nároky na šlechtění.* (*Modern soil cultivation for sugar beet and its demands on breeding*). (*pp. 141–48*).

Changes in cultural technique in Czechoslovakia have made necessary the breeding of new varieties adapted to the new methods; for example, varieties are required which tolerate deep cultivation of the soil and wide spacing. Also resistance to viruses is important, for modern cultural methods encourage the spread of viruses. Attempts are being made to breed monogerm varieties; crosses have been made with *Beta lomatogona*.

4189 *Olteanu, G. et al. Contributiuni la producerea semintei de sfecla de zahar in R.P.R.* (*Contributions to the production of sugar-beet seed in the Rumanian People's Republic*). (*pp. 149–96*).

The selection procedures used in the production of élite seed are described. It is noted that in trials held in 1955 introduced varieties were generally lower in sugar content than Rumanian sugar beets.

4190 *Bandlow, G. Die Genetik der Beta-Rübe.* (*The genetics of* Beta). (*pp. 197–212*).

[Cf. XXV, 3161].

4191 *Benc, S. Stav našeho šlechtěni na odolnost a toleranci.* (*The position of our breeding for resistance and tolerance*). (*pp. 213–16*).

A short account is presented of breeding for resistance to *Cercospora* and viruses carried out at the Semčice station in Czechoslovakia. Leaf characters determining resistance to *Cercospora* are being studied.

4192 *Rosnowski, S. Rozwój badań nad burakami cukrowymi w Polsce w ciągu ostatniego dziesięciolecia.* (*Progress of investigations on sugar beets in Poland during the course of the last decade*). (*pp. 249–63*).

An account of the organization of sugar-beet production, including breeding and genetics, is presented. Breeding and genetical studies are carried out at the Institute for Plant Selection and Acclimatization and at the plant breeding stations of the Ministry of Agriculture.

4193 *Rosnowski, S. Rejonizacja odmian buraków cukrowych w Polsce na podstawie doświadczeń.* (*Regionalization of sugar-beet varieties in Poland on the basis of trials*). (*pp. 264–75*).

In Polish trials E varieties showed a greater response in yields of roots and sugar to high soil fertility than Z varieties. Under the continental conditions obtaining in south-eastern Poland, varieties tolerant of drought yielded almost the same quantity of roots as E varieties, while in the remaining regions, under intensive cultivation, the E varieties held first place. N varieties gave good yields in all areas. The highest sugar content was found in Z types in northern regions, and in E types in south-eastern regions.

4194 *Zana, J. Die Untersuchung der Leistungsfähigkeit und Eigenschaften von Zuckerrüben auf Grund während mehrerer Jahre und an mehreren Orten durchgeführter Versuchsserien.* (*The study of the productive capacity and the properties of sugar beets on the basis of trial series conducted over several years and in several localities*). (*pp. 276–82*).

In trials of Hungarian and introduced varieties, conducted in Hungary during 1951–54, N varieties gave better yields of sugar than varieties of the Z or E types. Absolute values

for sugar and ash content varied from place to place but the relative values for the different varieties were fairly constant. Content of noxious nitrogen was strongly affected by cultural conditions. Varieties of the Beta series, particularly the polyploids, and Buszczyński CLR were relatively resistant to *Cercospora.*

4195 *Zana, J. Die vom ungarischen Forschungsinstitut der Zuckerindustrie angewandten Feldversuchsmethoden und die mit ihnen gewonnenen Erfahrungen.* (*The field-trial methods used by the Hungarian Sugar Industry Research Institute and experiences gained by their means*). (*pp. 283–95*).
In Hungarian trials, analysis of variance is used in evaluating results, the trial lay-outs used being random blocks, Latin squares, Latin rectangles and the split-plot method.

4196 *Fiedler, J. Srovnávací pokusy s domácími a zahraničními odrůdami cukrovky.* (*Comparative trials with native and foreign sugar beet varieties*). (*pp. 296–303*).
Czech and foreign varieties of sugar beet were compared. Beta 1 and Beta 3 were the most resistant to *Cercospora* and the Dobrovice varieties gave the best yields. The differences in resistance to *Cercospora* did not greatly influence the performance of the varieties.

4197 *Kargl, R. Rayonisace cukrovky s ohledem výsledky odrůdových zkoušek.* (*Standardization of sugar beet as viewed from the results of varietal trials*). (*pp. 320–26*).
Mention is made of varietal trials carried out in Czechoslovakia with native and foreign varieties. Suggestions are made concerning the organization of further trials.

4198 *Žak, V. Výsledky srovnávacích odrůdových pokusů a jejich ekonomické hodnocení.* (*The results of comparative varietal trials and their economic value*). (*pp. 327–39*).
The importance of comparative field trials is emphasized and the results of trials conducted in Czechoslovakia from 1952 to 1954 are summarized in tabular form. Native varieties have proved superior to foreign introductions.

4199 *Buzanov, I. F.* (*Basic principles of planning the control of pests and diseases of sugar beet in the Soviet Union*). (*pp. 467–82*). [*Russian*].
The resistance of P028 to *Cercospora beticola*, of F986, K018 and K08 to mildew, and of V020 and U752 to storage diseases is noted.

4200 *Kovács, A. Der Einfluss der virosen Vergilbung* (*Yellows*) *auf die* Cercospora *resistenz der Zuckerrübe.* (*The influence of virus yellows on* Cercospora *resistance in sugar beet*). (*pp. 530–35*).
The presence of virus yellows decreased resistance to *Cercospora beticola* both in varieties which are normally susceptible and in those which are normally resistant.

4201 *Silin, P. M.* (*Technological evaluation of sugar beet*). (*pp. 704–10*). [*Russian*].
Equations relating sugar production to digestion value, amount of nonsugars in the molasses and the coefficient of molasses formation are presented.

4202 *Drachovská, M. & Šandera, K. Technologická jakost cukrovky.* (*The technological quality of sugar beet*). (*pp. 724–54*).
Methods of determining biological, chemical and physical properties of sugar beet are described.

4203 Mazlumov, A. L.
Despre mărirea procentului de zahăr şi îmbunătăţirea calităţii sfeclei de zahăr. (**On raising the sugar percentage and improving the quality of sugar beet**).
An. Romîno-Soviet. : Ser. Agric. 1955 : No. 4 : 64–78.
[Cf. XXV, 3273].

4204 Grinko [Grin'ko], T. F.
Soiuri noi de sfeclă de zahăr şi metodele de cultivare a lor. (**New varieties of sugar beet and methods of cultivating them**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 1 : 104–14.
[Cf. XXVI, 553].

4205 Roussel, N., Wauthy, R. & Martens, M.
Les résultats des essais comparatifs de variétés de betterave sucrière en Belgique de 1954 à 1958. (**The results of comparative trials of varieties of sugar beet in Belgium from 1954 to 1958**).
Publ. tech. Inst. belge Amélior. Better. 1958 : **26** : 149–79.
A full report is presented of the results of trials of many varieties, data being provided on yield of roots, sugar and fresh foliage per ha. and other agronomic characters.

4206 Oltjanu [Olteanu], G.
**(Breeding and seed production of sugar beet in the Rumanian People's Republic).**
Sahar. Svekla (Sug. Beet) 1958 : No. 8 : 45–47. [Russian].
The breeding aims and breeding methods employed are referred to briefly. A series of varieties bred during the period 1948–1957 are cited. They include Lovrin 532 and Bod A1, both derived from Buszczyński CLR, which are interesting for their high yield.

4207 Cleij, G.
**Use of plastic tubes in raising beet seedlings.**
Euphytica, Wageningen 1959 : **8** : 89–92.
The use of polyethylene tubes, 10 cm. in circumference and 20 cm. in length, for raising seedlings in beet breeding work is described. The tubes are light, take up little space and allow the seedlings to form better-shaped roots.

4208 Mazlumov, A. L.
**(Mičurinist science, the basis of success in breeding sugar beet).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 7 : 7–13. [Russian].
This article discusses achievements in the last ten years, with emphasis on Mičurinist methods [cf. XXVIII, 1939]. The results include monogerm beets, beets resistant to *Cercospora* or bolting and recent varieties from Ramon' and Verhnjačka which combine high root yields with a sugar content of 20%.

4209 Tourneur, E. & Deneuche, J.
L'évolution génétique de la graine de betterave industrielle. **(The genetic evolution of the seed of industrial beet).**
Agric. prat. 1959 : **123** : 64–65.
Brief notes are provided on the characters of polyploid beets and the production of polyploid seed.

4210 Gallarate, G.
Le varietà poliploidi di barbabietole nella sperimentazione della A.N.B. **(Polyploid beet varieties in the tests of the National Beet-growers' Association).**
G. Bieticult. 1958 : No. 8 : p. 3.
A report is given of tests carried out for the first time in 1952 with a Danish polyploid sugar beet which exceeded the best diploid variety by 8·3% in total yield of sugar. In 1953 the top two places were taken by this same polyploid and a German polyploid. In 1954 a third from Sweden was added and in tests carried out all over Italy these three yielded 4·5, 4·8 and 7·4% more sugar per ha. than the mean. In 1956, seven polyploid varieties figured in the trials and four of them took the first four places for yield of sugar, all seven being above the mean. In 1957 the first seven places were taken by polyploids.

4211 Lobanov, V. Ja., & Leurda, I. G.
**(Seed production of sugar beet in the German Democratic Republic).**
Sahar. Svekla (Sug. Beet) 1958 : No. 6 : 44–46. [Russian].
This article mentions a recently approved triploid variety Multa N, which is now being multiplied at Kleinwanzleben. It has a higher sugar content than the bolting-resistant triploid Verna and, their root yields being the same, produces 3 c. more sugar per ha. The new variety is resistant to *Cercospora*. The method of multiplication referred to as the "inbreeding-heterosis" method employed at the institute is described. It consists in selecting typical roots, dividing them lengthwise, and growing about 50 of them to a small plot from which foreign pollen is kept out by a barrier of hemp 8 m. wide. The $F_1$ from every plot is tested separately and the best selected lines undergo another test before intercrossing with other selected lines and a further test later.

4212 Doxtator, C. W. & Finkner, R. E.
**Sugar beet germination selection results in osmotic pressure solutions. I. Germination methodology and osmotic selection effects on germination of four varieties.**
J. Amer. Soc. Sug. Beet Tech. 1958 : **10** : 237–46.
In 1·5% sucrose and salt solution, selections for early and late sprouting were made among the seeds of four multigerm varieties, 2, 3N, 3LSR and 3S. This solution, presumably the Cl′ ion, was found to have a toxic effect upon the seeds and reselections were made in 7·5% inositol solution. These progenies were then tested for germination in 7·5% inositol and in distilled water. The results show that early-sprouting selections of all four varieties germinated significantly better than the late-sprouting selections

when tested in inositol. In distilled water, three of the early selections compared were significantly superior. A higher concentration of inositol is needed to obtain further improved early sprouting types, but late sprouting selections lack the ability to absorb moisture from osmotic solutions so further selection of these will be difficult.

4213 Doxtator, C. W., Hanzas, P. C. & Olson, R. F.
**Sugar beet germination selection results in osmotic pressure solutions. II. Yield and chemical constituents of progenies, of four varieties from osmotic selection.**
J. Amer. Soc. Sug. Beet Tech. 1958 : **10** : 247–53.

Results of early and late-sprouting selections [cf. 4212] showed that though the early-sprouting progenies were higher in yield than the late-sprouting selections and the parent variety in 1956, later selections gave no evidence of differences in yield or chemical characteristics. Hence there is no conclusive proof that selection in osmotic solutions can be used to change yield and quality. The increased rate of germination found in the early-sprouting selections will tend to improve yield as a secondary effect.

4214 Lüdecke, H. & Nitzsche, M.
Entwicklungsverlauf verschiedener Zuckerrübensorten. Mehrjährige Feldversuche über Ertragszuwachs, Zuckerbildung und Nährstoffaufnahme unter besonderer Berücksichtigung des Reifegrades der Zuckerrübe. (**The course of development of different sugar beet varieties. Several years' field studies on yield increase, sugar formation and nutrient uptake with special consideration of the stage of maturity of the sugar beet**).
Landw.-ang. Wissensch. Undated : No. 95 : Pp. 62.

The results are reported of investigations conducted at Göttingen with E, N, Z and Polybeta varieties. The beets were harvested at regular intervals from June onwards and the yield of roots and foliage and their chemical composition were determined for each harvest. A high polarization value was found to be associated with a low sodium content. The varieties could be differentiated by the K : Na ratio. In the Z variety the $Na_2O$ content of the dry matter of the root reached a fairly stable value by about 1 October, whilst the Na content of the other varieties did not reach a stable value until about three weeks later. The E variety made the best use of the nutrients and the N and Z varieties came next in this respect.

4215 Orlovskij, N. I.
(**The differences between sugar beet varieties in degree of earliness**).
Sahar. Svekla (Sug. beet) 1958 : No. 7 : 35–39. [Russian].

Growing varieties for early or late digging is discussed and tables showing the root and sugar yields and sugar contents of different varieties at various Soviet research institutes are presented. Varieties which yield the most sugar per unit area at the first digging are also, in general, the most productive of sugar at later diggings in the same locality. Exceptions are provided by P028 and R06 at the Pervomajskaja Breeding Station and B742 and M2 at Bijsk, where the early varieties R06 and B742 were more productive at the first digging but were outyielded by the late ones at the second digging.

4216 Grodzinskaja, G. S.
(**Some characteristics of the progenies of biological groups of a tonnage variety of sugar beet**).
Sahar. Svekla (Sug. Beet) 1958 : No. 8 : 38–41. [Russian].

Biotypes differing in maturation period and ability to maintain the leaves fresh till the end of the growth period were selected within the variety VI591 at Belaja Cerkov'. A table shows the sugar contents and root yields of the progenies of the above selections in 1955 and 1956 and also of the progenies of (1) late x late biotypes and (2) early x midseason biotypes, where the early parent was one that maintained the leaves fresh till the end of the growth period. The midseason and late biotypes and the progeny of the early x midseason biotypes had the highest sugar content and produced the most sugar. The early biotype with leaves soon drying up was inferior to all the others.

4217 Špaldon, E. & Šínsky, T.
Priečny prierez stopkou listu cukrovej repy ako sortový znak. (**The cross section of the sugar beet petiole as a varietal character**).
Sborn. vysok. Škol. pol'nohospod. Nitre : Agron. Časť. : Ser. A. : 1957 : **1** : 107–19.

A large number of measurements were made of the cross section of the petiole of eight

Czechoslovakian varieties but constant varietal differences were not found.

4218 Martens, M.
Observations préliminaires sur la lignification des betteraves sucrières effectuées en Belgique, au cours de l'année 1958. (**Preliminary observations made on the lignification of sugar beets in Belgium during the year 1958**).
Publ. tech. Inst. belge Amélior. Better. 1958 : **26** : 181–200.

Polyploid varieties were more fibrous than N and E types. Two of the polyploid varieties tested were much less fibrous than the other polyploids; it may therefore be possible to select types of low fibrosity. No relationship was found between degree of lignification (fibrosity) and sugar content or bolting.

4219 Grin'ko, T. F.
**(Ways of improving sugar content and increasing sugar yield in beet).**
Sahar. Svekla (Sug. Beet) 1958 : No. 10 : 39–45. [Russian].

The breeding methods employed at Verhnjačka for development of varieties such as V031 and V038 combining high root yields with a high sugar content are described [cf. XXVIII, 1964]. In addition to the above, four new strains have recently been produced by repeated individual plant selection of V125, a hybrid between a tonnage and a Z type, and by intercrossing the best biotypes. In 1956 these strains had root yields of the order of 409–430 c. per ha., a sugar content of 20.3-20·7% and sugar yields of 84·6–87·3 c. per ha. The corresponding values for the standard variety R06 were 396 c., 19·1% and 70·3 c. respectively.

4220 Mazlumov, A. L.
**(Increasing the sugar content of beet).**
Sahar. Svekla (Sug. Beet) 1958 : No. 7 : 7–10. [Russian].

This article, dealing with agronomic measures for improving sugar yields, mentions a breeding technique used for improving sugar content at Ramon'. It involves single-plant selection of promising biotypes and subsequent intercrossing. The recent variety R023, which was bred in this way, has a 0·8% higher sugar content than the standards in the Voronež and Tambov provinces. The older variety R06 was also greatly improved by this method.

4221 Benc, S., Lapár, M. & Švorc, J.
Šlechtění řepy cukrové na odolnost proti *Cercospora beticola* Sacc. II. Výsledky křížení odrůd Dobrovická N a Buszczyński CLR. (**Breeding sugar beet for resistance to *C. beticola* Sacc. II. The results of a cross of the varieties Dobrovice N and Buszczyński CLR**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1958 : **31** : 1447–56.

Dobrovice N and Buszczyński CLR were crossed by open pollination in a plot containing about equal numbers of both varieties; by this method a 100% cross was not obtained. The resistance to *C. beticola* of the progenies was intermediate to that of the parents; Buszczyński CLR x Dobrovice was affected less than the reciprocal cross but neither cross attained the level of resistance of Buszczyński CLR. The yield of roots of the progenies was in most cases lower than that of Dobrovice N; yield of roots appeared to decrease with increasing resistance to *C. beticola*. Sugar content of the hybrids was also intermediate, being greater than that of Dobrovice N. In tests held at Čiky, the yield of polarization sugar from $F_1$ to $F_2$ generations was about half way between the parental yields; the hybrids gave better results at Semčice, where a longer vegetative period is possible This cross appears to be promising for combining improved resistance to *C. beticola* with a high yield of polarization sugar.

4222 Shepherd, A. M.
**Testing populations of beet eelworm, *Heterodera schachtii* Schmidt, for resistance-breaking biotypes, using the wild beet (*Beta patellaris* Moq.) as indicator.**
Nature, Lond. 1959 : **183** : 1141–42.

The development of individual females of *H. schachtii* on the hitherto resistant species *B. patellaris* is reported for the first time. Further investigations are required to determine to what extent these biotypes can give rise to populations containing a larger proportion of such individuals. It is pointed out that since one of the possibilities considered in breeding sugar-beet resistant to this nematode is introduction of genes for resistance from *B. patellaris*, a situation favouring multiplication of such biotypes could arise as the result of growing sugar beet x *B. patellaris* hybrids in the field.

4223 Bennett, C. W. & Tanrisever, A.
**Curly top disease in Turkey and its relationship to curly top in North America.**
J. Amer. Soc. Sug. Beet Tech. 1958 : **10** : 189–211.

Varieties of sugar beet, *Linum usitatissimum* and *Phaseolus vulgaris* were inoculated with the Turkish strain of curly top and the resulting symptoms compared with those produced by the North American strain 3. The sugar-beet varieties showed the same order of resistance to the Turkish strain as to strain 3 but the symptoms produced were less severe. Varieties of both *L. usitatissimum* and *Ph. vulgaris* showed a slightly different order of resistance to the Turkish strain.

## STIMULANTS

4224 Psarev, G. M. & Solov'ev, A. P.
**(At the A. I. Mikojan All-Union Tobacco Scientific Research Institute).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 57–61. [Russian].

A number of tobacco varieties obtained by selection and intervarietal or interspecific hybridization at the above institute and its branch stations are cited. Worth mention are Ostrolist 2747 [Pointed-leaf 2747], which is highly productive of large leaves, and Dubec 7, Dubec 566 and Trebizond 161. The last three were obtained by interspecific hybridization and are immune to *Erysiphe* and tobacco mosaic virus.

4225 Volodarskij, N. I.
**(Tobacco growing in China).**
Tabak (Tobacco) 1959 : No. 1 : 41–44. [Russian].

Idu Šan'dunskij Mnogolistnyj [Shantung Many-leaved Idu] was bred at the Tobacco Research Station, Shantung province, where its yield is double that of local varieties. Mention is also made of a productive short-day cultivar originating from Yunnan. It produces stems 3–3·5 m. tall and 120–150 leaves per plant under the climatic and soil conditions of Shantung.

4226 Avaljan, L. M.
**(A study of some intervarietal tobacco hybrids).**
Nauč. Trud. erevan. Univ. (Sci. Rep. Erevan Univ.) 1956 : **54** : 87–93; from Ref. Ž. (Ref. J.) 1958 : No. 9 : Abst. 38057 : 32–33. [Russian].

$F_1$ hybrids between varieties with contrasting morphological and economic characters were studied. It was found that sessile leaves were dominant to petiolate leaves; leaf shape resembled that of the maternal parent though some plants of intermediate or paternal type occurred; in yield and number of leaves per plant the hybrids were intermediate, but in earliness they tended to be closer to the earlier parent.

4227 Latterell, R. L.
**Morphogenetic investigations on somatic instability in the $F_1$ hybrid of *Nicotiana glutinosa* by *N. glauca*.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–5881 : p. 1177. (Abst.).

The aim of these investigations was to determine the nature of the leaf malformation and dwarf growth characteristic of $F_1$ *N. glutinosa* x *N. glauca*. Neither the parent species nor the amphidiploid exhibited abnormalities comparable with those in the $F_1$ hybrid. The triploid (*N. glutinosa* x *N. glauca*) x *N. glauca* was somatically stable, whereas (*N. glutinosa* x *N. glauca*) x *N. glutinosa* was dwarfed and bore variegated, irregular leaves. Anaphase bridges at mitosis occurred with a relatively high frequency in the $F_1$ hybrid, amphidiploid and (*N. glutinosa* x *N. glauca*) x *N. glutinosa*; their occurrence in the parent species was negligible. A number of developmental differences were found between the two species, $F_1$ and amphidiploid. Rates of leaf production were similar in all four forms. On account of its longer vegetative period, *N. glauca* produced about three times as many leaves as *N. glutinosa*. The $F_1$ and amphidiploid were intermediate in this respect. Other differences were found in (1) leaf length at a given node during early development of the plant, (2) rate of increase in mature-leaf length with node number, (3) internode length and (4) absolute rates of growth for individual leaf dimensions. For all of these characters the sequence of relative magnitudes was *N. glauca* > amphidiploid > *N. glutinosa* > $F_1$. Interspecific disparities in leaf form reflected differences in patterns of leaf development. Leaf growth was allometric throughout ontogeny and the basic pattern of leaf-shape development was similar in all four forms. Relative growth curves for the two species, representing the regression of leaf length on width, differed in slope and inflection points. The $F_1$ and amphidiploid resembled *N. glutinosa* in the early developmental pattern of the leaves. A subsequent "switch" in the $F_1$ resulted in an alteration of the pattern of leaf-shape development to one similar to that of *N. glauca*. The

fact that no comparable switch occurred in the amphidiploid accounted for the similarity of its leaves to those of *N. glutinosa*. Since the stage of development at which the symptoms of somatic instability first appeared in the leaves of the $F_1$ closely corresponded with the stage at which the alteration in developmental pattern occurred, it may be inferred that the two phenomena are connected.

4228 Smith, H. H., Stevenson, H. Q. & Kehr, A. E.
**Limits and consequences of multiple allopolyploidy in *Nicotiana*.**
Nucleus, Calcutta 1958 : **1** : 205–22.

Seeds of the hybrid *N. bigelovii* ($n = 24$) ♀ x (*N. debneyi* x *N. tabacum*) ♂ ($2n = 48$) were treated with colchicine and the allopolyploid of the three species was produced in 1949. The chromosome number of one plant was found to be $2n = 72$ and all subsequent generations were derived from this individual. Its progeny segregated markedly in morphology, vigour and fertility. Three lines, designated races A, B and C, were established as the result of inbreeding and selection for fertility and morphological distinctness for ten generations. A was chosen for low growth habit and small leaves and flowers. B was more upright, with large leaves. C was selected chiefly on the basis of wrinkled leaves and relatively large flowers. By the $S_{10}$ the lines approached the parental species in fertility and morphological uniformity. Examination of two of the most fertile plants of each race revealed the following $2n$ numbers. A, 112 and 114; B, 102 and 104; and C, 108. Chromosome elimination had therefore taken place during the production of the races, but in spite of selection for widely different phenotypes, the numbers had become relatively stable at $108 \pm 6$ in the $S_{10}$. At metaphase I in the $S_{10}$ of the three races, one or more chromosomes frequently failed to reach the plate, probably on account of overcrowding, so that only 12% of the metaphases were normal. Mostly bivalents were formed, presumably as a consequence of low chiasma frequency associated with the shortness of the chromosomes and the prevalence of homogenetic pairing. At succeeding stages of microsporogenesis, the percentages of normal cells were markedly higher. Judged by stainability, over 90% of the pollen was normal. As indicated by the results of crosses of $S_7$ plants as the ♀ parents, reproductive isolation between the three races and the parental species was considerable or complete. The reproductive isolation between the races was slight, as shown by the results from reciprocal intercrosses of $S_{10}$ plants. Fourteen quantitative morphological characters were studied in each species and race. The species differed significantly with respect to 92% of the comparisons of means, while among the races 74% of the means were significantly different. The races differed significantly from the species in 87% of the comparisons of means. A and B showed no marked resemblance to any one parental species, evidence thus being provided that no preferential elimination of chromosomes of a particular genome had occurred. C, however, resembled *N. bigelovii* more closely than *N. debneyi*. The races tended to be more stable than the parental species in number of days from sowing to anthesis, plant height and number and dimensions of the leaves, when grown in two contrasting environments. The possible role of higher allopolyploidy and subsequent aneuploidy in the future evolution of members of *Nicotiana* and the possible value of synthetic multiple allopolyploids in breeding are briefly discussed.

4229 **"S.C. 58" is new black shank resistant tobacco.**
Crops & Soils 1959 : **11** : No. 7 : p. 19.

A new flue-cured tobacco variety, SC58, highly resistant to black shank (*Phytophthora parasitica*) and comparing favourably in yield and quality with Hicks and other susceptible varieties, is to be released. It has good seedling vigour, is of medium height and bears 18 to 22 medium-sized erect leaves. It had an average nicotine content for a 3-year period of 3·83% and a total sugar content of 18·36%.

4230 Moore, E. L., Jones, G. L. & Powell, N. T.
**NC 73—new tobacco variety.**
Res. & Fmg. 1959 : **17** : No. 3 : p. 3.

NC 73, from (Dixie Bright x Bottom Special) x Beltsville 1–76, is a new moderately yielding variety, highly resistant to black shank (*Phytophthora parasitica* var. *nicotianae*), moderately resistant to *Fusarium oxysporum* var. *nicotianae* and susceptible to *Pseudomonas solanacearum*. The cured leaf is similar to "old line" types and is medium bodied with normal grain, texture, aroma and flavour. It is not likely to be grown widely on account of its only moderate yield but it increases the range of black-shank resistant varieties.

4231 Krishnamurthy, K. V. & Bhat, N. R.
**Staminal teratology in the genus *Nicotiana*.**
J. Indian bot. Soc. 1959 : **38** : 84–92.

Heritable and nonheritable modifications of the

stamens observed at the Central Tobacco Research Institute, Rajahmundry, India, are described. The former comprise (1) pistillody and (2) stigmatoid anthers in *N. alata*, (3) rudimentary sterile stamens in *N. tabacum* and (4) fasciated stamens in (*a*) *N. megalosiphon* x *N. glauca* and (*b*) *N. glutinosa* x *N. trigonophylla* x *N. megalosiphon*. Abnormality (3) was controlled by two recessive genes [cf. XXVII, 2085].

4232 Breese, E. L.
**Selection for differing degrees of out-breeding in *Nicotiana rustica*.**
Ann. Bot., Lond. 1959 : **23** : 331–44.

Measurements of the difference in level between the stigma and the ring of anthers (heterostathmy) were obtained by subtracting stamen length from pistil length, both distances being taken from the base of the superior ovary. In this way a stigma projecting above the anthers was indicated by a positive value and the reverse position by a negative one. Intraline selection was made in four successive selfed generations for positive values in one group of three lines and for negative values in another group of three lines. Selection for positive heterostathmy was relatively successful, whereas selection for negative heterostathmy resulted only in homostathmy. Positive heterostathmy was associated with retarded anther dehiscence and homostathmy with relatively early dehiscence. Tests under natural conditions of pollination showed that the rate of outbreeding was considerably influenced by the degree of heterostathmy and time of anther dehiscence, the positively heterostathmic lines with retarded dehiscence having a comparatively high rate of outcrossing. It is thus concluded that the rate of outbreeding in this species is under a genetic control which allows a rapid adjustment to changing conditions affecting the breeding system.

4233 Kinpyo, T., Mizuno, T. & Fujita, S.
**(Studies on fresh tobacco leaf. XIV. A comparison of the composition of yellow sorts as affected by variety and soil type).**
Shizuoka Daigaku Nogakubu Kenkyu Hokoku/Bull. Fac. Agric. Shizuoka Univ. 1957 : No. 7 : 109–17. [Japanese].

Data are provided on leaf production, leaf colour, dry matter, nitrogen content, in particular nicotine and protein, carbohydrate content, ethereal extract and ash for three narrow-leaved and three broad-leaved yellow tobaccos grown on three different soil types in Japan.

4234 Goodspeed, T. H. & Thompson, M. C.
**Cytotaxonomy of *Nicotiana*. II.**
Bot. Rev. 1959 : **25** : 385–415.

This review supplements an earlier one appearing in 1945 [XVI, 862] by providing a survey of work published since. It draws extensively upon material to be found in the first-mentioned author's monograph on the genus [XXVI, p. 131].

4235 Higase, S.
**(Physiological studies on tobacco flowering. I. The effect of water-logging after the transplantation stage on developmental response).**
Nihon Sakumotsugaku Kai Kiji (Proc. Crop Sci. Soc. Japan) 1958 : **27** : 299–300. [Japanese].

Four American varieties, when grown on water-logged soil, showed accelerated flowering and a decrease in the number of leaves. These effects were most pronounced in the case of Bright Yellow.

4236 Garber, E. D.
**Further observations on biochemical mutants of *Pseudomonas tabaci*.**
Bot. Gaz. 1959 : **120** : 157–61.

Additional information is given on the response of methionine-requiring mutants to many compounds either known or assumed to be involved in the biosynthesis of this aminoacid [cf. XXVIII, 1991]. The results suggested that the mode of methionine biosynthesis differs in this species from that in other bacteria. The exotoxin produced by *Ps. tabaci* behaves as a methionine antimetabolite, an observation which may be related to the biosynthesis of methionine. Data are also given on the reactions of *Nicotiana* spp. and varieties of *N. tabacum* to many biochemical mutants [XIX, 1838]. The mutants each displayed a pattern of virulence and avirulence towards susceptible species and varieties. No mutant was however virulent for a species or variety which was resistant to the parental strain. Virulence and avirulence of biochemical mutants of *Ps. tabaci* are interpreted on the basis of availability or unavailability of the required nutrilite at the site of inoculation. Three ways in which avirulence may arise are suggested. (1) The host may provide an inadequate concentration of the required compound. (2) The host may provide an adequate concentration but the presence of other compounds may inhibit uptake of the nutrilite. (3) In the case of certain tryptophane-requiring mutants, the host may provide an adequate

concentration but other compounds may be needed to facilitate uptake.

4237 Gooding, G. V. & Lucas, G. B.
**Effect of inoculum level on the severity of tobacco black shank.**
Phytopathology 1959 : **49** : 274–76.

Tobacco varieties representing different levels of black-shank resistance were inoculated with various concentrations of zoospores of *Phytophthora parasitica* var. *nicotianae* in controlled greenhouse tests. A disease index based on the rapidity of disease development was calculated. Rapidity and severity of disease development were directly related to the number of spores used. Alteration of the environmental conditions affected disease development.

4238 Moore, E. L. & Powell, N. T.
**Dominant and modifying genes for resistance to black shank of tobacco.**
Phytopathology 1959 : **49** : 318–19. (Abst.).

In breeding flue-cured varieties the cigar-wrapper variety Florida 301 has been used as a source of resistance to *Phytophthora parasitica* var. *nicotianae*. Susceptible varieties have been used as recurrent parents in the development of resistant varieties. Resistance seemed partially dominant and influenced by the choice of the susceptible parent when lines 5346 and 6047, selected in the $F_2$ generation from black-shank-resistant Dixie Bright 102 x susceptible Bottom Special x susceptible Bel 1–76, were used in crosses. Modifying genes also appeared to be present in susceptible varieties used as parents. There was evidence that line 5346 contained one or more genes for resistance that were not present in the other selected line, 6047. A different source of black-shank resistance, line 1002 from the Santo Domingo cigar-wrapper variety Quin Diaz, acted similarly.

4239 **Two new tobaccos.**
Agric. Res., Wash. 1959 : **7** : No. 11 : p. 16.

The release of the flue-cured tobaccos SC58 and NC73, highly resistant to black shank, is briefly reported. They are intended for Atlantic coast states.

4240 Troutman, J. L. & Fulton, R. W.
**Resistance in tobacco to cucumber mosaic virus.**
Virology 1958 : **6** : 303–316.

Neither tolerance nor hypersensitivity to the cucumber mosaic virus has been found within the genus *Nicotiana*. At the University of Wisconsin investigations have now been made on the tendency of tobacco plants to escape infection; the relative susceptibilities of different varieties were determined by comparing the numbers of lesions induced by a strain of virus selected for its ability to incite necrotic lesions on tobacco. The ratio of lesion counts on the most resistant variety, on a standard type and on the most susceptible variety was approximately 1 : 5 : 20. The resistant variety TI245 also showed only a few lesions when inoculated with tobacco mosaic, necrosis and streak viruses and with turnip mosaic virus. There was no evidence that this type of resistance was associated with the presence of virus inhibitors. When the plants were kept in darkness for 24 hr. before inoculation, the susceptibility of TI245 increased more than did the susceptibility of the standard variety. It therefore appeared that resistance was conditioned by some physiological factors. Also resistance seemed to be determined by multiple genetic factors, for $F_2$ plants from crosses between resistant and susceptible types ranged from very susceptible to resistant. Some hybrid progenies seemed to be more resistant than the resistant parent.

4241 Hitier, H. & Izard, C.
Essais de lutte contre la mosaïque du tabac par la chimiothérapie et par l'hybridation et la sélection génétique. **(Experiments on the control of tobacco mosaic by chemotherapy and by hybridization and genetical selection).**
Ann. Inst. exp. Tab. Bergerac 1958 : **3** : 85–96.

From the triple hybrid *Nicotiana glutinosa* x *N. sylvestris* x *N. tabacum* var. *purpurea* [cf. XIX, 2736] and from the sesquidiploid *N. tabacum* 'P11' x *N. glutinosa*, lines resistant to mosaic have been obtained at Bergerac. Lines of the first mentioned hybrid give satisfactory yields but the quality is not acceptable. But these plants may prove useful for introducing resistance into cultivated varieties. From a cross between one of these lines and the variety Sumatra acting as the seed parent, a line was isolated which is promising for the production of cigar tobacco. One of the resistant lines of *N. tabacum* 'P11' x *N. glutinosa* has yielded a product very similar to that of P11. The two Paraguay types P11 and P19 have also been crossed with the resistant variety Samsun from the USA. However the hybrids inherited the small size and poorly developed leaves of

Samsun and very few $F_2$ plants resembling the Paraguay tobaccos were obtained.
The line Cv60 (Ambalema x Filipino) was crossed with P11 and P19 with a view to incorporating the resistance of Ambalema in the French varieties. This cross is easy to effect and the resistance is inherited as a recessive character; it is however linked to certain morphological characters which are not generally desired in France. The leaves are relatively narrow like those of Ambalema.

4242 Kramer, E.
Elektrophoretische Untersuchungen an Mutanten des Tabakmosaikvirus. (**Electrophoretic investigations on mutants of tobacco mosaic virus**).
Z. Naturf. 1957 : **12b** : 609–14.

Two series of mutants were studied, one belonging to the *vulgare* and the other to the *dahlemense* group. The two groups, which were distinguishable serologically and by the symptoms produced, could also be distinguished electrophoretically, but within each group there was no parallelism between the alterations in biological symptoms produced by the different mutants and their electrophoretic mobility.

4243 Aach, H. G.
Serologische Untersuchungen an Mutanten des Tabakmosaikvirus. (**Serological investigations on mutants of tobacco mosaic virus**).
Z. Naturf. 1957 : **12b** : 614–22.

A series of sequential mutants of the strain *vulgare* was serologically investigated, the ultimate members of the series having been selected as producing symptoms similar to those of the *dahlemense* strain. Each mutation was accompanied by a small alteration in the original antigenic properties, the alteration being retained in the subsequent mutants. Group specificity remained unchanged, however, and no approach to the *dahlemense* serological properties was observed.

4244 Aach, H. G.
Spektrophotometrische Untersuchungen an Mutanten des Tabakmosaikvirus. (**Spectrophotometric investigations on mutants of tobacco mosaic virus**).
Z. Naturf. 1958 : **13b** : 165–67.

Differences in tryptophane and tyrosine contents determined spectrophotometrically were found between two groups of mutants derived from the *vulgare* and *dahlemense* strains respectively but none was detected within the groups.

4245 Aach, H. G.
Quantitative Aminosäuren-Analysen an Mutanten des Tabakmosaikvirus. (**Quantitative analyses of amino-acids in mutants of tobacco mosaic virus**).
Z. Naturf. 1958 : **13b** : 425–33.

Marked differences in the contents of eight aminoacids, as determined by paper chromatography, were found between the strains *vulgare* and *dahlemense* and slight but significant differences were detected between the mutants derived from them. Assuming a molecular weight of about 16,000 for the peptide chain forming the unit of which the protein shell of the virus is composed, it was found that: for the mutation *vulgare* → *flavum*, two aspartic acids were replaced by one alanine and one valine per chain; for *flavum* → *necans*, one alanine was changed to one phenylalanine; for *necans* → *virescens*, one valine was lost and one aspartic acid gained; and for *dahlemense* → *luridum*, one glutamic acid was replaced by one leucine.

4246 Steinberg, R. A.
**Comparison of daylength and temperature responses in *Nicotiana* and its taxonomic sections.**
Amer. J. Bot. 1959 : **46** : 261–68.

Information is provided on the reactions of 57 *Nicotiana* spp. to long and short days at 25° C. or at a day temperature of 20° C. and night temperature of 10° C. The species showed long-day, neutral or short-day responses under one or both of the temperature conditions. Short-day species were native to South America. Australian and North American species behaved in most cases as long-day plants at one or other of the temperature levels. Photoperiodic reactions showed good agreement with Goodspeed's taxonomic classification. Except in the case of sects. *Paniculatae* and *Undulatae*, representatives of sections containing more than a single species were similar in day-length response.

**Annual Report of the Tocklai Experimental Station of the Indian Tea Association 1957** : Pp. 243.

4247 *Botanical branch.* (*pp. 35–41*).

Some populations cultivated as tea are probably interspecific hybrids [XXVII, 3330]. Five progenies, produced by controlled transfer of pollen between clones, are being tested under estate conditions in different localities. One of the crosses was characterized by a noticeable Darjeeling flavour, not associated with tea grown at Tocklai under plains conditions.

4248 *Wight, W. Selection policy in tea estates of north-east India.* (*pp. 58–68*).
Work on generative and vegetative clones is described. It is recommended that estates practise the selection and propagation of vegetative clones. Seed production from generative clones is only in the developmental stage.

**Symposium on tea rehabilitation and replanting, Colombo, 28th November, 1958.**
Tea Quart. 1958 : **29** : 141–253.
The proceedings of the above symposium, held in Colombo during November 1958, are given. The following items are of most interest to breeders. In addition, appendices II and V give information on the performance of clones in Ceylon.

4249 *Visser, T. The position of clonal selection in Ceylon in relation to replanting.* (*pp. 154–59*).
Progress made during the past 20 years in the selection of clones at the Tea Research Institute, St. Coombs, and on commercial estates with respect to rooting ability, yield, quality and resistance to several diseases and pests is assessed.

4250 *Kehl, F. H. Experiences overseas on replanting with high yielding material.* (*pp. 160–63*).
Based on the author's observations during visits to Georgia in the USSR, Assam and Anamallais and Nilgiris in southern India, notes are given on breeding to develop improved clones in those countries.

4251 *Keegel, E. L. Selection and quality.* (*pp. 178–79*).
Comments are proffered on problems of selecting clones for quality.

4252 Deuss, J. J. B.
La culture et la fabrication du thé. (**The cultivation and manufacture of tea**).
J. Agric. trop. Bot. appl. 1958 : **5** : 429–53.
The second instalment of this review includes a survey of different types of tea and their nomenclature and the breeding carried out in Formosa, Japan, Assam and Ceylon.

4253 Osone, K.-I.
**Studies on the breeding of triploid plants by diploidizing gamete cells.**
Ikushugaku Zasshi/Jap. J. Breeding 1958 : **8** : 171–77.
Buds of tea plants, in which the anthers were at the meiotic stage, were treated with colchicine. Giant pollen grains constituted about 10·5% of the pollen produced per flower and were applied to the stigmas of diploids. Of the 53 flowers pollinated, 7 developed into fruits, each of which contained only one seed. Root-tip examination revealed the two seedlings raised to be triploid. According to the criterion of percentage of flowers producing giant pollen, the most satisfactory technique was treatment with 0·05% colchicine solution for 3 days, the buds having been previously pricked with pins and wrapped in cotton wool.

4254 Kutubidze, V. V.
(**Intravarietal supplementary pollination of the tea plant with a pollen mixture**).
Agrobiologija (Agrobiology) 1958 : No. 4 : 53–56. [Russian].
Supplementary pollination of hybrid and commercial strains by mixed pollen of other plants of the same strain had the following effects as compared with open pollination. The plants set more fruits, the capsules being larger and heavier and a higher proportion of them had two or three locules; in open pollinated plants the highest percentage of capsules were unilocular. Supplementary pollination also improved seed viability and raised seed extraction rate including that of high-grade seeds. Minor varietal differences in response to the mode of pollination are noted. For instance, hybrid strains showed a greater improvement in fruit setting and larger increases in fruit weight than the commercial strain and Hybrids 3 and 7, in contrast to all others, showed a reduction in seed extraction rate.

4255 Harada, S., Watanabe, A. & Kano, T.
(**The influence of the conditions of growth of the mother plant on the characteristics of the shoots of tea varieties to be used as cuttings and on the rooting capacity and growth of the cuttings after removal**).
Chagyo Kenkyu Hokoku/Tea Res. J. 1958 : No. 12 : 5–13. [Japanese].
Nine varieties subjected to various pruning treatments were studied. Both treatment and variety affected the subsequent behaviour of the cuttings. The variety Y3, which had the lowest nitrogen content in the leaves, had the poorest rooting capacity; in general, a high content of nitrogen in the leaves was correlated with prompt rooting. A low content of nitrogen in the stem was associated with good root production and shoot growth. Large stems and leaves in the mother-plant variety were also

associated with superior shoot growth in the cuttings.

4256 Ueno, K., Saito, H., Iwahori, G. & Fukatsu, S.
**(An examination of the characteristics of black teas from various varieties).**
Chagyo Kenkyu Hokoku/Tea Res. J. 1958 : No. 12 : 38–54. [Japanese].
A detailed assessment is made of the style, liquor and taste of black teas prepared from the varieties Benihomare, C17, C18, C19 and C21.

4257 Wu, C.-T., Wu, H.-K. & Fong [Feng], C.-H.
**(The distribution of hair on the plucked leaf of tea varieties and its correlation with yield and quality).**
Chung-hua Nung-hsueh Hui Pao/J. agric. Ass. China 1958 : No. 24 : 78–82. [Chinese].
Hair length and hair density of the plucked leaf were ascertained for a number of locally grown varieties and for their $F_1$ hybrids. The values in the $F_1$ were, in general, intermediate between those of the parents. Significant positive correlations were found between (1) hair length and quality of the oolong tea and (2) hair density and quality of the black tea.

4258 Wight, W.
**Nomenclature and classification of the tea plant.**
Nature, Lond. 1959 : **183** : 1726–28.
The author shows how tea agrotypes may be classified according to a metrical system entailing the frequency of calcium oxalate crystals in the petiole [cf. XXVIII, 4543]. Agrotypes defined by crystal frequency have been found to be related to leaf-form agrotypes in var. *assamica*, as distinguished on the basis of ratio of plants with glossy and matt leaves, and to tasters' scores for quality in var. *sinensis*.

4259 Bahtadze, K. E.
**(The breeding of winter-hardy tea varieties).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 7 : 22–30. [Russian].
Varieties bred at the USSR Tea Institute differing in degree of winter hardiness are mentioned [cf. XXVIII, 801]. Seven of these have been made standards in different districts of Georgia and the hardiest among them also along the Black Sea Littoral in the Krasnodar territory. The latter standards include a variety with large leaves, Zugdidskij Krupnolistnyj [Zugdidi Large-leaved].

4260 Coste, R.
Perspectives ouvertes par les recherches agronomiques pour l'amélioration de la production caféière dans l'Union Française. **(Prospects opened by agronomic research for the improvement of coffee production in the French Union).**
Café, Cacao, Thé 1958 : **2** : 59–67.
This general review includes a brief mention of breeding in progress on the Ivory Coast, in French Equatorial Africa and in Madagascar.

4261 Bouharmont, J.
Recherches sur les affinités chromosomiques dans le genre *Coffea*. **(Research on chromosome affinities in the genus *Coffea*).**
Publ. Inst. nat. agron. Congo belge : Sér. Sci. : 1959 : No. 77 : Pp. 94.
The following species were found to have a somatic chromosome number of 22: *C. congensis*, *C. kivuensis*, *C. eugenioides*, *C. canephora*, *C. ugandae*, *C. liberica*, *C. dewevrei* var. *excelsa*, *C. abeokutae*, *C. klainii*, *C. stenophylla*, *C. lebruniana* and *C. horsfieldiana*; *C. arabica* has 44 chromosomes. The hybrids QP (*C. liberica* x *C. canephora*) and Conuga (*C. congensis* x *C. canephora*) are diploid and Kawisari D (*C. liberica* x *C. arabica*) is tetraploid. *Psilanthopsis kapakata* (= *C. kapakata*) has 36 somatic chromosomes and these differ morphologically from those of the *Coffea* species. Nuclear structure and mitosis were found to be similar in all the *Coffea* species studied. Chromosome lengths were estimated and the total length for 22 chromosomes varied between 26·8 and 35·3 $\mu$; *C. horsfieldiana* was the only species to differ significantly from the others in this respect, its chromosomes being shorter. Similarities in chromosome length are not sufficient to determine affinities between species but confirm relationships based on morphological and other characters. Idiograms are given for each species. Ten African species have very similar idiograms and an average idiogram is described for these species; the idiograms of *C. abeokutae*, *C. lebruniana* and *C. horsfieldiana* differ from those of the other 10 species. From these studies it is concluded that the species investigated are closely related and there does not appear to be any great obstacle to hybridization between species of similar chromosome number.

4262 Devreux, M., Vallaeys, G., Pochet, P. & Gilles, A.
Recherches sur l'autostérilité du caféier Robusta (*Coffea canephora* Pierre). [**Research on the self sterility of Robusta coffee (*C. canephora* Pierre)**].
Publ. Inst. nat. agron. Congo belge : Sér. Sci. : 1959 : No. 78 : Pp. 44.

It has been shown that under strict conditions of self pollination this type of coffee is self sterile. The sterility results from the failure of the pollen to grow down the style and reach the ovules. It is suggested that *C. canephora* possesses several sterility alleles and that growth of the pollen tubes is inhibited when the pollen carries an allele identical to one in the style.

4263 Mes, M. G.
Estudios sobre la florescencia del *Coffea arabica* L. (**Studies on the flowering of *C. arabica* L.**).
IBEC Res. Inst., NY undated : Pp. 41.

In trees grown under controlled conditions, day and night temperatures of 23° and 17° C. respectively resulted in the initiation of a larger number of floral buds than the temperature combination of 26°/20° C. and 30°/24° C. but also in a delay in flowering compared with higher temperatures. Bud dormancy occurred at all temperature combinations when the corolla had reached a length of 4–5 mm. In trees grown for long periods at the higher temperature, abnormal stellate flowers were frequent. Dormancy of the flower buds could be broken by placing the cut flowering branches in water or in a 0·2 M. sugar solution or by applying water to the cut ends of branches on the trees or to the nodes. The last two treatments gave rise to localized flowering only, and more abundant flowering was induced by submerging the entire crown in water. The rapidity of the reaction was higher at higher cultivation temperatures. Various chemical and cutting treatments were without effect. The cessation of dormancy was associated with the occurrence of meiosis in microspore mother cells. Evidence of a deficient water supply to the flowers was obtained from the observations that (*a*) high tensions occurred in the water columns of the xylem, occasioned by the inelasticity of the mesophyll elements of the leaf, so that little difference in water content was found between transpiring and saturated leaves and (*b*) peduncles of the inflorescence had well-developed phloem but only a small proportion of xylem elements, so that water was not readily absorbed.

4264 **Report of the first FAO technical cacao meeting, Accra, Ghana, 8-15 February 1959.**
Mtg. Rep. FAO UN, Rome 1959 : No. 1959/1 : Pp. 32. (Mimeographed).

Among the topics discussed during the various sessions were: methods of selection and breeding; experimental designs for variety and other trials; and the proposed FAO projects dealing with (1) exploration for native cacaos and the establishment of world collections and (2) expansion of international cooperation in basic research projects.

4265 Bennett, M. C. & Cope, F. W.
**Nuclear fusion and non-fusion in *Theobroma cacao* L.**
Nature, Lond. 1959 : **183** : p. 1540.

Previous investigations have revealed that the incompatibility reaction in *Th. cacao* is based on nonfusion between ♂ gametes and ♀ haploid nuclei carrying the same dominant *S* allele [cf. XXVIII, 3274]. In ovules in which fusion does not take place, the egg and ♂ nuclei always appear to be in actual contact, each preserving its spherical shape. The second ♂ gamete and polar nuclei do not however show such regularity of behaviour, the two polar nuclei sometimes becoming dissociated from each other and the ♂ nucleus lying in contact with one of these separated nuclei or elsewhere in the embryo sac. When fusion does occur between a ♂ gamete and polar nucleus, the gamete invariably places itself at some point on the line of juncture of the two polar nuclei, so that the ♂ nucleus lies in simultaneous contact with both polar nuclei. The ♂ nucleus then penetrates between the polar nuclei, assuming a more and more fusiform shape. Finally, the contents of the ♂ nucleus mingle with the nucleoplasm of one of the polar nuclei. This fusion behaviour may be likened to the coalescence of oil droplets in an extremely unstable oil-water emulsion, while the case of nonfusing nuclei may be regarded as analogous with a stabilized oil-water emulsion. It is postulated that, when the ♂ and two polar nuclei carry the same dominant *S* allele, a substance interfering with fusion diffuses from the cytoplasm of the ♂ gamete into that associated with the polar nuclei and interacts with specific sites on the surface of both polar nuclei, so that the three nuclei are protected against fusion or "stabilized". Under such conditions, the separation of the polar nuclei sometimes observed in ovules showing nonfusion would be understandable. No specific adsorption sites appear to be present on the surface of polar nuclei carrying the recessive allele, since

fusion with any ♂ nucleus will always take place. When the polar nuclei carry a dominant *S* allele different from that in the ♂ gamete, fusion will ensue. For example, $S_3$ polar nuclei in an $S_{3\cdot4}$ genotype will fuse with $S_1$ ♂ gametes derived from an $S_{1\cdot2}$ genotype because the $S_3$ sites are not specific adsorption sites for the $S_1$ protective substance. If the ♂ nucleus does not carry a dominant *S* allele, no protective substance is present in its cytoplasm; it will therefore fuse with any ♀ nuclei. Finally, it is postulated that, in view of the specificity of the reaction involved in nonfusion, the protective substance is probably proteinaceous.

4266 Hlaváčková, Z.
Křížení máku, zaměřené ke zvýšení obsahu morfinu v suchých makovicích. (**The crossing of poppy with a view to increasing the morphine content of dry poppy heads**).
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 521–36.

At Carlsbad university the morphine content of dry poppy heads was found to be an hereditary character greatly influenced by environmental conditions, especially temperature and rainfall during the ripening period. Varieties differed markedly in their soil and climatic requirements. The yield of seed was also much influenced by environmental conditions.
$F_1$ hybrids showed heterosis with respect to seed weight and plant height but morphine content was in most cases intermediate between the parental values. A study of $F_2$ progenies indicated that morphine content is a quantitative character under polygenic control.

4267 Zabrovskij, A.
(**Hop, an important plant**).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : 70–71. [Russian].

New hops from Žitomir, clones 32–10 and 1–15, and hybrids 8–4 and 9–32, produce 24·8 to 25·9 c. cones per ha. and have a resin content of the order of 17·4 to 21%. They all outyield clone 18 and the older varieties and are resistant to pests and diseases.

4268 Gudanavičius, S.
Apynių hibridizacija ir selekcija LTSR ma botanikos sode. (**Hybridization and selection of hops at the Botanic Garden of the Academy of Sciences of the Lithuanian SSR**).
Lietuv. TSR Moksl. Akad. biol. Inst. Darb. 1958 : **3** : 325–30.

Descriptions are given of four hybrids selected from unidentified open-pollinated material. All are highly productive, with fine-quality cones and growth periods not exceedings 135 days. Seedling A1–6 has the shortest growth period, 95–105 days; the other three are resistant to *Pseudoperonospora.*

## MINOR CROP PLANTS

4269 Boháč, J.
Metodika šľachtenia koreninovej papriky. (**A method for breeding paprika**).
Sborn. vysok. Škol. pol'nohospod. Nitre : Agron. Časť. : Ser. A. 1957 : **1** : 15–32.

The characteristics required by the cultivator, industry and the consumer in *Capsicum annuum* are discussed and the breeding method developed at Nitra, Czechoslovakia, is described. This method involves selecting individuals and testing their progeny for yield, quality and disease resistance; multiplication of selected plants takes place in isolation, for *C. annuum* is only facultatively autogamous.

4270 Wilson, J. Y.
**A third species of 'pepper' in West Africa.**
Nature, Lond. 1959 : **183** : p. 1142.

The new species *Capsicum sinense* reported by Smith and Heiser [cf. XXVIII, 3280] as occurring in Central and South America has been found in West Africa, in addition to *C. annuum* and *C. frutescens.*

4271 Greenleaf, W. H.
**Breeding tobacco-etch-virus-resistant Tabasco-type peppers.**
Phytopathology 1959 : **49** : p. 317. (Abst.).

Breeding these peppers in the southern USA has been carried out since 1953 using PI152225 as a source of resistance. Prospects are good for the development of a desirable etch-resistant Tabasco type that will also be superior to this variety in certain other characteristics.

4272 Cook, A. A. & Anderson, C. W.
**Multiple virus disease resistance in a strain of *Capsicum annuum*.**
Phytopathology 1959 : **49** : 198–201.

Five viruses, namely TMV (tobacco mosaic), TEV (tobacco etch), PVY (potato-Y), CMV (cucumber mosaic) and ARSV (aster ring-spot) have been isolated from bell pepper plants in Florida. One strain, P11, reacted in a hypersensitive manner to most strains of TMV tested, was tolerant or resistant to the strains of TEV tested and was unaffected by all the potato

virus-Y strains used. Graft inoculations established that virus Y can move through P11 stems, but failed to demonstrate that the virus can multiply within the plants. The reactions of P11 plants to the viruses used were compared with those of *C. frutescens* var. Tabasco and *C. annuum* var. SC. 46252. Plants of the P11 strain were susceptible to AMV (lucerne mosaic), CMV and ARSV.

4273 Artjugina, Z. D.
**(The effect of day length upon the growth, development and yield of sweet pepper).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 138–40. [Russian].

Eight varieties were given treatments of 12 hr. days, instead of the 14 hr. natural day, before transplanting at Majkop and all grew and developed quicker and yielded more fruit. The improved yield was accounted for by increased number of fruits on a plant. A table of varietal differences in response to the treatment shows that some treated varieties grew taller than under natural days, while others showed no change in this respect and that the 12 hr. photoperiod hastened the flowering of late varieties such as Californian and Oš Koš to a greater extent than early or midseason varieties.

4274 Jdanov [Ždanov], L. A.
Principalele rezultate obţinute în munca de selecţie a plantelor oleaginoase. (**The principal results obtained in breeding oil plants**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 77–92.

[Cf. XXVI, 1621].

4275 Armour, R. P.
**Investigations on *Simarouba glauca* Dc. in El Salvador.**
Econ. Bot. 1959 : **13** : 41–66.

*S. glauca* may prove to be adaptable as an oil crop in marginal areas, especially as it produces at least 62% by weight of edible oil. Selection on a limited scale has begun for yield and size of fruit, weight of kernel, oil content and tree form. Observations show that male, female and andromonecious trees occur. Material is being selected from proven gynodiecious trees for vegetative propagation.

4276 Dharampal Singh.
**Self-incompatibility in *rai* (*Brassica juncea* Coss) and its importance in the production of hybrid seed.**
Indian Oilseeds J. 1959 : **3** : No. 2 : 95–99.

In a mutant studied at the Government Research Farm, Kanpur, UP, and found to depend upon a single recessive gene, the stigma protrudes from the bud two to three days before the flower opens and is fully receptive at this stage. The stamens at the time of anther dehiscence reach only half way up the style. The flowers fail to open or open very little. The pollen is normal in viability, although the mutant produces less pollen than normal plants. The very low percentage of pod setting resulting from selfing indicated that the mutant is self incompatible. The floral morphology and self incompatibility render the mutant almost 100% cross pollinated. The pods are very small and contain only one or two seeds. As the result of crossing the mutant with heterozygous normal plants for two generations under conditions of natural pollination, many additional mutant plants have been obtained which, while retaining the floral morphology and self incompatibility of the original type, are considerably better as regards pod size, pollen production and flower opening. Some of the mutants have equalled the normal type in pod size. Methods of maintaining the mutant and using it in the production of $F_1$ hybrid seed are suggested. Work has recently been initiated at the Regional Research Centre (Oilseeds and Millets), Kanpur, on the various aspects of hybrid production, using this mutant. The possibility of utilizing a similar mutant found in yellow sarson (*B. campestris*) for the production of $F_1$ hybrids of this crop is also being explored.

4277 Manner, R.
**Studies in $F_1$ and $F_2$ of crosses between winter and summer turnip rape.**
Maataloust. Aikakausk. 1959 : **31** : 31–37.

Four winter turnip-rapes, Rapido, Gruber, Sprengel and Storrybs [Large turnip-rape] have been crossed at the Gullåker Plant Breeding Institute, Hammenhög, Sweden, with the summer turnip-rape Mette, with a view to obtaining a higher-yielding type and also to obtaining leafy types suitable for fodder production. Characteristics of $F_1$ and $F_2$ hybrids are described. Seed setting took place in about 75% of the Rapido x Mette hybrids, and the seed yield of all the $F_1$ hybrids that set seed was greater than that of Mette. The seed yield per plant was highest in Rapido x Mette, but the yield per siliqua was greatest in Gruber x Mette. All hybrids were taller than both parent varieties, Rapido x Mette being the tallest. In the $F_2$, vegetative development was vigorous in all cases, particularly in the Storrybs x Mette hybrid. Mean seed weight per siliqua was

considerably higher in the hybrids than in Mette, the Storrybs x Mette hybrid giving the highest figure.

4278 Lityński, A.
Badania nad zimotrwałością i mrozoodpornością rzepaku. Część I. Badania niektórych cech fizjologicznych rzepaku ozimego, związanych z jego zimotrwałością i mrozoodpornością. (**Studies on winter hardiness and frost resistance in rape. I. Studies of some physiological characters of winter rape in connexion with its winter hardiness and frost resistance**).
Roczn. Nauk rol. : Ser. A. 1957 : **76** : 685–708.

Refractometric analyses of the cell sap of the root neck of 14 varieties revealed both intervarietal differences in dry-matter content and differences due to density of sowing. Varieties also differed in the degree of water imbibition by the seeds, the greatest imbibition being found in Warsaw 21 with a value of 70·97% and the lowest in Koszaliński and Warsaw 17, with 58% and 58·37% respectively. The relations between dry-matter content, imbibition, protein content of the seeds, degree of bolting in spring-sown material and depth of the root neck varied in different varieties. Fat and protein content of the seed varied with year and variety. The severe winter of 1956 destroyed the whole crop, so that the above results could not be related to frost resistance.

4279 Rautou, S.
Le ricin en France méridionale. (**The castor oil plant in southern France**).
Ann. Inst. nat. Rech. agron., Paris : Sér. B. 1958 : **8** : 75–112.

At Montpellier selection for high yield, increased oil content and characters which facilitate harvesting, such as indehiscence, is in progress. Of the varieties and hybrids tested, the semi-late $F_1$ hybrid H–6 is mentioned for its high productivity. The results of the tests show that the unisexual female character favourably influences yielding capacity; attempts are being made to produce a unisexual female hybrid of Cimarron x Conner.

4280 Orellana, R. G.
***Botrytis* leaf blight of *Ricinus communis* L.**
Plant Dis. Reptr. 1959 : **43** : 363–64.

Variation in the resistance of unspecified strains of castor bean to blight caused by *Botrytis ricini* in Florida is reported.

4281 Kobayashi, T.
**Radiation genetics of sesame. Part III. Morphological changes and mutants induced by ionizing radiations.**
Idengaku Zasshi/Jap. J. Genet. 1958 : 239–61.

In the third paper in this series [cf. 2979] an account is given of the morphological variations induced by treating three cultivated forms with $P^{32}$, X rays, $\gamma$ rays or $P^{32}$ + X rays. The chief modifications were changed phyllotaxis and leaf shape, development of extrafloral nectaries into functional flowers, which in some cases produced capsules, and increase or decrease in the number of locules per capsule. A few mutants surpassed the control in seed yield. One of the three initial types, possessing bicarpellary and 4-locular capsules, two extrafloral nectaries per axil and alternate phyllotaxis, gave rise to a considerable range of variants, some of which were similar to the other two initial types or the mutants derived from them. It is therefore suggested that the first-mentioned type is the ancestor of the sesame varieties cultivated in Japan.

4282 Merxmüller, H.
Über die Gattung *Sesamum* L. in Südwestafrika. (**The genus *Sesamum* L. in south-west Africa**).
Mitt. bot. Staatssammlung München 1959 : **3** : 1–13.

Eight species, one of which exists in two varieties, are distinguished. *S. abbreviatum* is a new species. A key is provided and the seeds are illustrated.

4283 Nakamura, H. & Sato, T.
Étude et amélioration des sesames. I. Classification morphologique du genre *Sesamum.* (**Study and improvement of sesames. 1. Morphological classification of the genus *Sesamum***).
Hyogo Noka Daigaku Kenkyu Hokoku: Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1956 : **2** : 149–56.

As a result of morphological studies, eight species of *Sesamum* are classified into three groups irrespective of their chromosome numbers. Plants previously known as *S. capense* appeared to be either *S. alatum* or *S. schenkii*. *S. indicum, S. alatum, S. capense* and *S. schenkii* have $2n = 26$; *S. angolense, S. prostratum* and *S. angustifolium* have $2n = 32$ and *S. radiatum* $2n = 64$. *S. angolense* and *S. radiatum* strongly resembled each other and were placed in the

same morphological group; *S. radiatum* may be a polyploid of *S. angolense.*

4284 Large, J. R.
**"Big bud" of tung, a genetic variation.**
Proc. Fla. hort. Soc. 1958 : **71** : 323–24.
"Big bud" tung-oil trees have enlarged buds and stems, shortened internodes and numerous enlarged adventitious buds. Buds from a "big bud" tree were budded on to the base of normal seedlings. "Big bud" only developed on the shoot from the implanted bud, and adventitious shoots from above or below remained normal. Thus lack of spread of the "big bud" condition indicates that it is a genetic variation and not a virus disease.

4285 Georgieva, J.
**(Interspecific hybridization in plants).**
Selskostopan. Misăl 1958 : **3** : 384–85. [Bulgarian].
An account of crossing the sunflower with *Helianthus tuberosus, H. rigidus, H. decapitatus, H. lactiflorus* and *H. multiflorus,* together with descriptions of the $F_1$ and $F_2$, is presented. Crossability was improved by vegetative rapprochement and by accelerating the flowering of the pollen parent by subjecting it to short-day treatment. In discussing segregation, special mention is made of the progeny of (*H. annuus*/*H. rigidus*) x *H. rigidus.* Most of these plants had a short nonbranching stem and matured early; others had a branching habit and new characters such as inflorescences with a vanilla-like aroma and petals of a different colour from both parent species. A number of hybrids exceeding the sunflower cultivar 3–18 in seed and oil yields have been selected.

4286 Korol'kova, A. V.
**(Vegetative hybridization of the sunflower as a means of breeding for high oil yield).**
Zap. Voronež. sel'skohozjajstv. Univ. (Rec. Voronež agric. Univ.). 1956 : **26** : No. 2 : 107–09. [From Ref. Ž. (Ref. J.) 1958 : No. 2 : Abst. 4880 : p. 34]. [Russian].
Experiments on vegetative hybridization between the varieties Karlik [Dwarf] and Voronež 709 are reported. Karlik is ultraearly, has a high husk content and its seed and oil yields are low. The other variety is a productive mid-season type rich in oil and low in husk content. Some hybrids of Karlik/Voronež 709 exceeded the stock in earliness, productiveness and vigour and have been fertilized by a pollen mixture taken from other vegetative hybrids of the same kind to raise further plants.

4287 Ždanov, L. A.
**(The mentor effect of foreign pollen in pollination of the sunflower).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 7 : 14–21. [Russian].
The productiveness and vigour of the $F_1$ of the sunflower varieties Don 695, 2545 and 7032 was improved by pollinating with self pollen + castor-oil-plant pollen in studies of mentor effects at the Don Breeding Station. The addition of safflower, maize or *Sorghum* pollen resulted either in a very slight improvement in the $F_1$ or a reduction in productiveness and vigour.

4288 Kováčik, A.
Príspevok o koreňovom systéme niektorých odrôd slnečnice. **(A study of the root system of some sunflower varieties).**
Sborn. čsl. Acad. zeměd. Věd : Řada rostlinná Výroba 1958 : **31** : 1289–94.
Illustrated notes are provided on the morphology of the root system of several varieties. It is thought that this information may be of interest to breeders.

4289 Merfert, W.
**(Evaluating the élite plants of sunflower before pollination).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 123–25. [Russian].
A method of selecting breeding material for high oil content and other desirable characters which has been developed at Bernburg, Germany, is described. It is based on observations of the plants before the flowering of the central florets, analyses of the seed from the peripheral region of the inflorescence for dry-matter content of the husks and whole seed and calculations of the oil content of the seed head.

4290 Berdişev [Berdyšev], A. P.
Biologia dezvoltării floarei soarelui pentru sămînță în jurul Moscovei. **(Biology of development of sunflower grown for seed in the province of Moscow).**
An. Romîno-Soviet. : Ser. Agric. 1955 : No. 3 : 83–98.
[Cf. XXV, 2298].

4291 Matsuo, K., & Hirose, M.
**(Studies on the sterility of saffron).**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1955 : **2** : 49–50. [Japanese].

The percentage of viable pollen grains was low and no fertilized ova resulted from pollination.

4292 **Report of the Wattle Research Institute, University of Natal, for 1957–1958** (1958) : Pp. 40.

Selections have been made from the 60 first-generation inbred lines of black wattle. These lines show considerable uniformity between each family, but marked interfamilial differences. Scoring of inbred green wattle for diameter for the second time revealed the same relative differences between selfed and natural progenies as was found formerly [cf. XXIV, 1374]. Trees of progeny trials planted in 1955 showed significant interfamilial differences in height and diameter and a correlation between these two measurements. Trees of progeny trials planted in 1954 also show highly significant differences between families in diameter, quantity and type of lateral branches.

Analysis of tannin content from a quarter-height bark sample has been shown to give a good estimate of average tannin content of individual trees. This will be of value in eliminating those of low tannin content from future selections.

The tendency to forking appears to be under genetic control to some extent.

4293 Sundara Raghavan, R.
**Chromosome numbers in Indian medinical plants—III.**
Proc. Indian Acad. Sci. : Sect. B 1959 : **49** : 239–44.

The following 2*n* numbers are reported for the first time: *Sonneratia apetala*, 18; *Grewia tenax*, 36; *Cicca acida*, 26; *Celastrus paniculatus*, 46; *Ardisia solanacea*, *ca.* 46; *Holarrhena antidysenterica*, 22; *Evolvulus alsinoides*, 26; *Bacopia monnieri*, 64; *Curcuma angustifolia*, 64; and *Pandanus tectorius*, 60. The remaining three numbers given differ from those reported by other investigators. They comprise: *Putranjiva roxburghii*, 40; *Psoralea corylifolia*, 22; and *Strychnos nux-vomica*, 44. [Cf. 602].

4294 Ligeti, G.
Die Vererbung des Glykosidgehalts in den Blättern bei *Digitalis lanata* Ehrh.
**(The inheritance of glycoside content in the leaves in *D. lanata* Ehrh.)**
Pharmazie 1959 : **14** : 162–66.

Total glycoside content and the relative contents of lanatosides A and C varied strongly from plant to plant in studies carried out in Budapest. Open-pollinated progeny from mother plants particularly rich in one or the other glycoside showed a tendency towards more equal proportions of the two, but some stabilization of the distinct types was achieved by inbreeding for two generations. Crosses of a parent rich in lanatoside A with one rich in C gave highly variable progenies.

4295 Zakordonec, A. I.
**(The effect of day length and temperature on the growth period and yield of inflorescences of *Matricaria chamomilla*).**
Ukrajin. bot. Ž. (Ukrain. J. Bot.) 1958 : **15** : No. **4** : 16–23. [Ukrainian].

Conversion from the annual to the biennial habit and from spring to winter habit was observed in plants sown on different dates at Feofania. The conversions and changes in yielding capacity are attributed to altered temperature and photoperiodic conditions.

4296 **RRIM 600 series clones.**
RRI Plant Bull. 1959 : No. 41 : 28–33.

A summary is given of the results of a further year of trial of two series of rubber clones in Malaya, RRIM600–618 [cf. XXVIII, 4580] and RRIM619–630 [cf. XXVIII, 3313].

4297 Hara, K.
**(Rubber breeding in Indonesia).**
Nihon Ringaku Kai Shi/J. Jap. For. Soc. 1957 : **39** : 456–59. [Japanese].

The topics covered in this brief review include clonal and mother-tree selection, artificial hybridization, and breeding technique and trial layouts.

4298 **Annual Report of the Rubber Research Institute of Ceylon 1957** (1958) : Pp. 135.

Hand pollination was again restricted to specific crosses between high-yielding clones with vigorous growth and, in some cases, partial resistance to *Oidium heveae* and *Phytophthora palmivora*. AVROS 163, LCB 1320, Mil 3/2, PB 5/139, PB 86, RRIC 52, Wag 6278 and Tjir 1 were used as female parents. Where possible, high yielding RRIC clones, with clones PB 86, Tjir 1 and Wag 6278 as one of the parents, were used for back crosses.

The results of trials of clones established from hand pollinated seedlings and foreign and local clones are given. Among the foreign clones, PB 86 has maintained first place in yielding capacity in several trials, and AVROS 255, PB 6/50, PR 107, PRIM 513, PRIM 501, RRIC 1

and LCB 1320 continued to give good yields. A number of local clones are also proving promising. Further South American clones resistant to *Dothidella ulei* and *Ph. palmivora* have been introduced.

4299 Hilton, R. N.
**Pink disease of hevea caused by *Corticium salmonicolor* Berk. et Br.**
J. Rubb. Res. Inst. Malaya 1958 : **15** : 275–92.

This survey includes a short section on host reaction to *C. salmonicolor*, information being given on the reactions of a number of clones and seedling families, as observed in Malaya. The possible nature of resistance is also discussed; it is emphasized that response to artificial inoculation may not provide an indication of resistance to natural infection. A consideration of the pedigrees of some PRIM clones suggests that susceptibility is under genetical control.

4300 Pravdin, L. F.
**(The present position of scientific research with gutta-percha bearing *Euonymus* forms).**
Trud. Inst. Lesa (Trans. Inst. For.) 1958 : **46** : 5–10. [Russian].

Mention is made of mother trees of different species of *Euonymus* selected for high gutta-percha content at the Forestry Institute of the Academy of Sciences. It was found that this character was transmitted to the vegetative and sexual progenies.

4301 Čžao, Š.-H. [Chao, S.-H.]
**(Derris in southern China).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 9 : 117–19. [Russian].

Derris cultivation in the tropical and sub-tropical districts of China is discussed and a table is given showing the rotenone contents of a dozen cultivars. Hainan and Taiwan had the highest contents with 13·52 and 13·35% respectively. Among the other varieties Tajvanskij Polusteljaščijsja [Semiprostrate Taiwan] and Kwangsi-Luchou are interesting for their high root yields.

## FRUITS AND NUTS

**Annual Report of the Agricultural and Horticultural Research Station, Long Ashton, Bristol, 1957** : Pp. 181.

4302 *Summary of research*, 1957. (*pp. 23–48*).

Hybrids from different cider varieties and Worcester Pearmain have been raised in an attempt to produce an early-maturing cider variety of good quality, a requirement of the industry which is not fulfilled by any of the existing varieties. The cider variety Michelin is said to have "on" years when it is self compatible and "off" years when it is self incompatible. In studies with Laxton's Superb, Worcester Pearmain and Michelin, it was found that pollen from trees deficient in nitrogen was inferior in its capacity to bring about fertilization and fruit set compared with pollen from high-nitrogen trees. Different varieties react differently to α-naphthalene acetamide and α-naphthalene acetic acid used as thinning agents.

The fungistatic properties of the components of waxes on the leaves of two varieties of tomato differing in resistance to *Cladosporium fulvum* were studied; the ether-soluble acidic components of the wax inhibited the germination of the spores.

4303 *Wilson, D. Male sterility in Bristol Cross pear.* (*pp. 52–56*).

A study of pollen development, pollen germination and controlled pollinations of Bristol Cross indicated that it is male sterile, although a diploid, producing only 5 to 10% of viable pollen. It is suggested that the cause of pollen abortion is genetic but further experiments are needed to confirm this.

4304 *Rake, B. A. The classification of gooseberries: I. Useful characters for the classification of varieties.* (*pp. 60–65*).

Winter flowering, foliage, shoot and fruit characters, useful for describing varieties at different stages of development throughout the year, are discussed.

**Annual Report of the East Malling Research Station, near Maidstone, Kent, 1st October, 1957 to 30th September, 1958 (1959)** : Pp. 178.

4305 *Pomology.* (*pp. 7–12*).

**Apple.** Seedlings from selfings and inter-varietal crosses made with a view to combining good fruit qualities with lateness of flowering were planted out; selection based on lateness in leafing and resistance to scab and mildew was initiated.

**Pear.** A further attempt was made to cross pear and quince for the production of rootstocks having wide compatibility with pear varieties and good characteristics as regards propagation.

**Cherry.** Seedlings from selfings and crossings

among selected mazzards are to be examined as possible dwarfing rootstocks for cherries. Further batches of seed were obtained from crosses between *Prunus avium* and *P. tomentosa*, *P. pseudocerasus* and *P. incisa*.

**Raspberry.** Breeding for resistance to the virus vector *Amphorophora rubi* continued. Seven genes have been identified for resistance to the three strains of the aphid so far recognized. Two of the genes together confer adequate protection against all three strains. Transference of direct virus resistance and of other characters to parent lines reached a further stage. Ability to recover from frost by producing secondary fruiting laterals is being investigated genetically and transferred to parent lines.

**Currants.** Allotetraploids of black x red currant have been developed for back crossing to black currants in breeding for improved strig characters. Tetraploids of red currant and of black currant have also been raised for use as parents. In work on the transference of genes controlling fruit size from gooseberry to black currant varieties, seedlings from crosses of black currant x gooseberry allotetraploids with both diploid and tetraploid black currants were planted out.

**Gooseberry.** Families from selfings of Leveller, Whinham's Industry and Broom Girl underwent preliminary selection. Improvement of hybrids of Hunter's semispineless varieties with respect to fruit size continued.

4306 *Plant pathology.* (*pp. 25–30*).
Among the items reported is the occurrence of abnormal outbreaks of *Verticillium* wilt in tolerant varieties of hops in commercial plantings. No conclusive evidence has been obtained that a more severe strain has arisen. The possibility that the sites in question may provide especially favourable environmental conditions for a build-up of the pathogen in the soil is being investigated.

4307 *Entomology.* (*pp. 31–34*).
The investigations included testing apple seedlings for woolly-aphid resistance by means of inoculations made throughout the spring and summer. Seedlings of Court Pendu Plat x Northern Spy, found to be resistant the previous year, maintained their resistance. Of 220 seedlings of Cox's Orange Pippin x Northern Spy receiving initial tests, 52% were resistant. Although both Crawley Beauty and Irish Peach are resistant under field conditions, seedlings from the cross between the two varieties were all susceptible.

4308 *Preston, A. P. Apple rootstock studies: growth and cropping of Cox's Orange Pippin on some Malling and Malling-Merton rootstocks.* (*pp. 47–52*).
The results of trials of five stocks of the new Malling-Merton series in comparison with five of the Malling series are reported. The scions comprised Cox's Orange Pippin, Jonathan and Ellison's Orange. The Malling-Merton stocks tested were MM104, MM106, MM109, MM111 and MXXV. The first four are resistant to *Eriosoma lanigerum*. The fifth is less resistant and was therefore added to the original Malling series.

4309 *Rogers, W. S. & Fromow, M. G. Royal Sovereign strawberry clone M.415.* (*pp. 60–62*).
The new clone M415, released in 1957, yielded 11% more marketable fruit than the Malling clone M40 of Royal Sovereign in three replicated trials over a period of eight years. The superiority was mainly attributable to increases in the later pickings and a longer cropping season. The two clones were indexed as virus free and showed no difference in morphology or plant size. The better performance of M415 is thought to be due to mutation of genes affecting yield. Supplied by A. G. D. Greenshields, a Norfolk grower, the original plants were derived from an importation of the variety from Co. Mayo, Irish Republic.

4310 *Pearce, S. C. & Freeman, G. H. A review of experimental design at East Malling 1953–1958.* (*pp. 67–72*).
The topics reviewed include (1) effect of block and plot size, (2) partially systematic layouts, (3) number of factor levels, (4) successive experiments with the same material, and (5) unequal replications. [Cf. XXIV, p. 140, XXV, 2559, XXVI, 1946 and XXVII, 1001].

4311 *Posnette, A. F. & Cropley, R. A selection of Williams' Bon Chrétien pear compatible with quince rootstocks.* (*pp. 91–92*).
Three clones of Williams' Bon Chrétien, respectively from English, French and Swiss sources, were budded on Quince A stock. Examination of the graft unions showed the English scion to be highly incompatible, the French slightly incompatible and the Swiss compatible. It is suggested that bud mutation is responsible for the clonal differences in compatibility.

4312 *Wilson, J. F. Density, Defender and Janus: three new wilt-tolerant hops.* (*pp. 110–15*).
Density (D1) and Defender (D3), both seedlings of Keyworth's Midseason, have vigorous growth

and high yield potential. Janus (J2), a seedling of Whitbread's Golding, has moderate growth and yielding capacity. In time of maturity the varieties are respectively late, early and mid-season. Density and Defender are extremely susceptible to downy mildew while Janus has average susceptibility. The varieties have an ordinary degree of susceptibility to powdery mildew. All three are tolerant of *Verticillium albo-atrum* and tolerant carriers of mosaic virus. Density produces small and compact cones, likely to withstand damage by machine picking, while those of Janus are bold and borne in a manner likely to suit machine picking. In brewing trials, Density and Defender were suitable for replacing 25 and 50% of normal grist and received some favourable reports when used alone. Janus was acceptable for 25, 50 and 100% replacement and the similarity between this and the control in $\alpha$ - soft resin content suggested that substitution might be made on a weight-for-weight basis.

4313 *Legg, J. T. A mild strain of hop mosaic virus.* (*pp. 116–17*).

Cross-protection tests revealed that two types of mosaic, lethal and mild, are caused by strains of the same virus, *Humulus* virus 1. It is suggested that the two isolates studied are representatives of two groups of strains, severe and mild, distinguished by the lethality of the former to Golding hops.

4314 *Briggs, J. B. Methods for assessing resistance to* Amphorophora rubi (*Kalt.*) *in the raspberry.* (*pp. 121–26*).

In a survey of the resistance of varieties and unnamed seedling selections carried out in an insectary, the potted plants were repeatedly mass-infected with *A. rubi* strain 1. Strong resistance implied virtual immunity under the conditions of the test. Plants colonized by comparatively small numbers of aphids, often undersized and feeding, even early in the season, only on mature or senescent leaves, were classified as weakly resistant. Strong resistance was found in Baumforth A, the American variety Chief and some derivatives of these two varieties. Weak resistance was noted in Baumforth B, Hercules, Latham, Norfolk Giant, Royal Scot and in some selections, including 86/69 and 87/76. In breeding for resistance, seedlings have been subjected to a rapid test in the insectary, followed by field inspections. In the insectary test, a single adult aptera was placed on the first open leaf. Plants failing to be colonized after three transferences were classed as resistant. This simple technique has given a satisfactorily accurate forecast of resistance derived from Baumforth A, as judged by subsequent field observations. The use of aphid counts on the first flat leaves, one from each cane, offered an adequate means of checking the resistance of Baumforth A derivatives in the field during the early part of the season. Under insectary and field conditions, weakly resistant Norfolk Giant and its progeny gave anomalous results. It is concluded that in breeding for resistance, exploitation of a source of strong resistance is likely to lead to faster progress than attempting to assemble in one variety a number of genes for resistance with small individual effects.

4315 *Preston, A. P. Thirty-five years' results with some Malling clonal apple rootstocks.* (*pp. 148–50*).

A summary is given of the main results from the trial established 35 years ago to study the rootstocks M.IX, M.VII, M.IV, M.I, M.II and M.XVI, using Lane's Prince Albert, Worcester Pearmain and Cox's Orange Pippin as scions.

4316 *Sewell, G. W. F. & Wilson, J. F. Resistance trials of some apple rootstock varieties to collar rot* (Phytophthora cactorum). (*pp. 155–56*).

[Cf. 1907].

4317 *Wilson, J. F. Notes on three new wilt-tolerant hops.* (*pp. 161–62*).

For the benefit of growers, notes are given on the performance and characteristics of Density, Defender and Janus [cf. 4312].

4318 Gollmick, F.
Die Aufgaben der Grundlagenforschung bei der Züchtung krankheitsresistenter Obstsorten. (**The problems of basic research in breeding disease-resistant fruit varieties**).
Wiss. Z. Martin-Luther-Univ. Halle-Wittenberg 1958 : **8** : 51–52.

At the Phytopathological Institute, Naumburg, 350 cultivated apple varieties have been investigated for resistance to *Psylla mali*; only two unspecified varieties were completely resistant, these showing a hypersensitive reaction. Crosses have now been effected between the resistant forms and other cultivated varieties having particularly valuable properties. Observations on a large number of seedlings revealed that susceptibility to both *Ps. mali* and *Podosphaera leucotricha* is greatly influenced by climatic factors; resistance to both these organisms is genetically determined.
Other current investigations at Naumburg concern cold resistance of apples and resistance of vines to *Phylloxera* and *Peronospora viticola*.

4319 Sharpe, R. H. & Shoemaker, J. S.
**Development of temperate-climate fruits for Florida.**
Proc. Fla. hort. Soc. 1958 : **71** : 294–300.

The improvement of apples, pears, apricots, plums, cherries, peaches, nectarines, figs, persimmons, raspberries, blackberries, blueberries and grapes for Florida conditions is discussed briefly. Results are particularly promising for peaches, blackberries and blueberries. Attempts to cross warm-winter adapted apricots, nectarines, cherries and raspberries with the better fruiting northern varieties have also been made and this material may prove useful for future breeding work. As plums are self-incompatible, $Co^{60}$ is being used to develop self-fertile lines. Mention is made of attempts to breed a rootstock fig compatible with existent varieties and resistant to root-knot nematode (*Meloidogyne* sp.). Vines are being bred for resistance to Pierce's disease virus and for adaptation to the warm winter.

4320 Iakovlev [Jakovlev], P. N.
Despre metodele Miciuriniste de dirijare a dezvoltării pomilor fructiferi. (**On Mičurinist methods of directing the development of fruit trees**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 101–13.

[Cf. XXVI, 1724].

4321 Brooks, R. M., & Olmo, H. P.
**New varieties of tree fruits, berries, grapes.**
Amer. Fruit Gr. 1959 : **79** : No. 1 : 30–32, 34, 36.

Brief descriptions are provided of some varieties which appeared in late 1957 and in 1958.

**Apple.** Centennial and Northland are crab apples developed in Minnesota [cf. XXIX, 643]. Centennial is very good for eating fresh but not one of the best for canned sauce and jelly, whereas Northland is both good for eating and useful for other purposes. Northland is also relatively winter hardy and very productive. Clifton Red Rome is a bud mutation of Rome Beauty discovered in 1920 and introduced commercially in 1957; the skin is said to have a brilliant blush. Jonadel, produced at the Iowa Agricultural Experiment Station, has larger and milder fruit than Jonathan but has more acid than Delicious; the firm juicy flesh makes this a good dessert variety [cf. XXVI, 2764]. Clarkrich Red Queen, Ryan Red and Tonasket Red Delicious become coloured early in the season; they are all thought to be bud mutations of Starking.

**Pear.** Lacock, of unknown parentage, has firm sweet juicy flesh suitable for canning; it resembles Flemish Beauty.

**Loquat.** Fletcher, discovered in Bartow, Fla., yields fruit growing to 2 in. in length; the firm flesh is orange-red in colour and of good flavour.

**Apricot.** Valnur, bred in Washington, has a highly coloured skin and bears well; it matures early.

**Plum.** Salsa-Pride, thought to be an open-pollinated seedling of Late Santa Rosa, yields fruit of a Japanese-plum type; it does not split and the length of the fruit is about 3 in., the diameter being $2\frac{1}{4}$ to $2\frac{1}{2}$ in. It matures between 10 and 20 July.

**Peach.** Seven of the peach varieties described here have been dealt with elsewhere in *Plant Breeding Abstracts*. Of the others, Ben Owens is a yellow-fleshed freestone which appears to be winter hardy and Double Delight from California is a firm yellow freestone with a sweet flavour, ripening in early midseason before Saturn. Garabedian Hale is a highly-coloured, yellow-fleshed freestone maturing 10 days before J. H. Hale. Garnet, a bud mutation of Sunhigh, is a yellow-fleshed freestone with good flavour and texture, being similar in quality to Sunhigh and a good dessert variety. It matures just before Triogem. Golden Dawn, thought to be a Lovell seedling, is said to have melting yellow flesh of high quality with no red coloration around the pit. The skin is overlaid with red. Gold Hale, of unknown parentage, has yellow firm flesh with a mild flavour and good quality. The fruit is large, freestone and uniformly round in shape, the skin being deep red over a yellow ground colour. It ripens early in June in Farmersville, Calif. Kimbo has large yellow juicy fruit which is freestone when ripe; it matures about 10 days after Elberta at its place of origin in Maryland. Maffey is a white-fleshed freestone whose flesh does not oxidize readily; the skin is light green with a rose-coloured blush at the stalk end and the flavour is subacid and good. Maytime is an $F_1$ selection from a cross between the nectarine Sun Grand and Robin; it is a white-fleshed clingstone, ripening very early and resembling Springtime. Rancho Resistant, an open-pollinated seedling of S–37, is a rootstock; it is resistant to the root-knot nematode and the seeds germinate very well. Redwin is a semi-freestone with white flesh ripening before Mayflower; it has a short chilling requirement.

**Nectarine.** Compton, from Ivanhoe, Calif., is a yellow freestone when fully ripe but semi-clingstone at early stages of development; the

cooking quality is good, being equal to that of Elberta. Granderli is a yellow-fleshed freestone with light yellow skin overspread with red. The tree has a lower chilling requirement and crops more regularly than Early Le Grand. June Grand is an open-pollinated seedling of Early Sungrand. Its skin is dark red over yellow. Lexington, from the Virginia Agricultural Experiment Station, Blacksburg, is a yellow-fleshed freestone of medium firm texture ripening 7–10 days before Cavalier. The tree is very vigorous and tends to escape brown rot and damage by frost during flowering. Redbud from the same station is a sister seedling of Lexington; it is a white-fleshed freestone of medium texture and above average firmness and of good quality. It matures 27 days before Elberta. This variety also shows considerable ability to escape damage by brown rot and frost.

**Mulberry.** Illinois Everbearing is thought to be a polyploid derived from *Morus rubra*. The flavour is good and the tree is very hardy and productive.

**Almond.** Merced, a hybrid of Texas and Nonpareil, blooms and ripens at the same time as Nonpareil and has a thin, well-sealed shell. Ruby has a shell which is thicker, harder and better sealed than that of Nonpareil. It blooms about three days later than Texas but matures with Texas.

**Litchi.** Peerless, which originated in Oneco, Fla., is probably an open-pollinated seedling of Brewster. The tree bears regularly and the fruits are large, averaging 16 to 18 to the pound.

**Blackberry.** The variety Darrow is described [cf. 3083 and 3085].

**Gooseberry.** Welcome is described [cf. 643].

**Strawberry.** Headliner is described [cf. XXVIII, 4692]. Wild Flavour is an open-pollinated seedling of Dunlap with a high flavour.

**Grape.** Eleven new varieties have just been released by the California Agricultural Experiment Station. Calzin is suitable for the making of a dry red wine of the Zinfandel type; it has jet-black round berries, the skin having a high tannin content. Calzin has the flavour of Zinfandel and is a heavy producer; it is more tolerant of red spider than Zinfandel. Canner produces seedless berries suitable for canning; the berries are larger than those of Sultanina, brighter green in colour and ripen later. The vine is vigorous and productive. Early Muscat is a table variety, the medium-sized, uniform berries having a marked muscat flavour and dull yellow skin. It ripens just after Perlette. Although the vine is only of moderate vigour, it is very productive. Early Niabell ripens in the early midseason producing large, slightly oval purplish-black berries suitable for table fruit and the manufacture of fresh juice and semisweet wines. The vine is of medium vigour, very productive and tolerant of powdery mildew. This variety resulted from a cross between two tetraploid forms. Niabell, a tetraploid originating from the same cross which produced Early Niabell, yields large, spherical, jet-black grapes suitable for table use and the preparation of fresh juice and semisweet wines. The vigorous vines have long productive canes. Flora yields small dark green berries of high acid and sugar content and ripening in early midseason. These berries produce an aromatic white table wine of very high quality and flowery bouquet. This variety, which originated from a cross between Semillon and Gewürztraminer, is of medium productivity. Gold produces large firm oval berries with a tender skin having a golden sheen; it has a mild muscat flavour. This variety is particularly suitable for table use. It ripens in early August at Davis, Calif. Helena came from the same cross as Calzin and yields large clusters of yellow-white, soft and juicy berries, ripening in midseason. These produce a distinctive dry white wine. The vine is of the Zinfandel type. July Muscat, ripening in late July in the Fresno area of California, yields greenish yellow subovoid berries of medium size, suitable for table use. The firm flesh has a strong Muscat flavour and the skin is resistant to weather damage. Royalty produces small berries with dark red juice having high sugar and acid contents; the fruits ripen in midseason and produce a port-type wine. The highly productive semierect vine is tolerant of powdery mildew. Rubired is also a midseason variety yielding small berries with red juice. They are suitable for the production of sweet red wine and for blending with other products where an intense and stable red colour is desired. Cimarron is also described [cf. 1970].

4322 Tupicyn, D. I.
**(Fruits and vines in the province of Sinkiang).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 60–62. [Russian].

Wild and cultivated forms of quince, *Prunus domestica, P. simonii, P. tomentosa, P. divaricata* and plumcots are mentioned, in addition to the fruits referred to below.

**Apple.** The local cultivars comprise a few varieties of *Malus prunifolia* and *M. niedzwetzkyana*. Wild forms of the latter species were found in the district of Kunlun, but not in the basin of the river Ili which is regarded as its place of origin.

**Pear.** Mention is made of 3 cultivars of *Pyrus bretschneideri* with fruits of superior quality to those grown in central East China. Variety Našvanty from Čipan is especially interesting for its pleasant flavour and very large fruit.

**Peach.** Many varieties of *Prunus persica* and *P. ferganensis* with white or yellow flesh have been found. Some have free stones, others are clingstone types. Among the latter are some late-ripening varieties such as Aš Šaptul which keeps for 2 months. An extra-early variety thought to be valuable for breeding early peaches has been found in the Kargalyk district; it is known under the name of Suka Kutėk and in the district of Yarkand as Suhėk. It has white flesh and ripens as early as early apricot varieties.

**Fig.** Only one variety with large yellow fruit is grown.

**Pomegranate.** Ačik Onar with acid fruits, Širin Onar [Sweet pomegranate] with sweet fruits and Tatlyk Onar [Sweetish pomegranate] having both sweet and acid flavour are the principal cultivars.

**Jujube.** The cultivated forms are hardy and require no protection in winter.

**Vine.** The local forms mentioned include the currant variety Gunča Uzjum [Gunča grape] and Kišmiš Belyj [White Sultana] which has larger grapes than the central Asiatic variety with oval grapes known by the same name. Another variety, Kzyl-munak, closely resembles Tajfi Rozovyj [Pink Tajfi].

4323 Johansson, E. & Pääsuke, M.
Förvaringsförsök med odlade bär och plommon vid Alnarp 1954–1957. **(Storage tests with cultivated berries and plums at Alnarp, 1954–57).**
Medd. Trädgårdsförs. 1958 : No. 118 : Pp. 34.

Among 8–10 strawberries tested in 1954–55, Finn and Landia were best in keeping quality. Willamette, Malling Exploit, Malling Jewel and Miranda were the best of 8–10 raspberries tested in 1954–57. The best black currant, of which five varieties were tested in 1954–55, was Brödtorp. Among the 20 plums tested during 1954–57, storage quality varied from year to year and the results indicated that most European plums, if picked at the right time, can be kept for one week at 15° C. and for two at 5° C. For plums the best results were obtained with storage in open polythene bags, while for the other fruits closed bags were better.

4324 Spolītis, A.
Jaunas perspektīvas tautas selekcijas augļu koku šķirnes. **(New promising varieties of fruit trees selected by the people).**
Latv. PSR Zināt. Akad. Vestis 1958 : No. 5 : 45–48.

Two apples and one plum belonging to unknown local varieties have been selected among adult trees in different districts of Latvia for their high yield, winter hardiness and fruit quality. Both apples are resistant to diseases.

4325 Schaer, E.
Eine Tabelle über die Essreife und Lagerfähigkeit von Kernobstsorten im Hauskeller. **(A table on ripeness for eating and keeping capacity of pome fruits in the cellar).**
Schweiz. Z. Obst- u. Weinb. 1959 : **68** : 284–85, 286–87.

Tabular information is provided on the storage period and the period during which the fruit is ripe for eating of 24 apple varieties and 17 pears, the apples being kept at 4–7° C. and the pears at 10–15° C. External conditions greatly affect keeping capacity and time of ripening. Lists are provided of varieties suitable for different purposes, such as drying or cake making.

4326 Thiele, I.
Progressive Frostresistenzprüfungen an Kernobstsämlingen. **(Progressive frost resistance tests with pome fruit seedlings).**
Diss. Inst. Obstb. tech. Univ. Berlin 1956 : Pp. 61.

Comparative tests of the resistance to freezing of a large number of open-pollinated seedlings of 24 apple and 6 pear varieties are reported. The mother plants giving the most resistant progeny were Borsdorf Kitajka [Borsdorf Chinese crab] and Landsberger apples and Kirchensaller pear. A trial of seedlings from controlled pollinations failed to reveal any overall effect of the pollen parent upon the frost resistance of the progeny, and the cross Borsdorf Kitajka x Cox, for instance, gave rise to seedlings much more resistant than the reciprocal.

4327 Sedov, E. N.
**(Apple varieties for the province of Orel).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : 49–50. [Russian].

Anis Seryj [Grey Anis] and Anis Alyj [Scarlet Anis] were among the hardiest and most productive varieties which have been tested at the Orel Horticultural Research Station. Wealthy and Pepin Šafrannyj [Saffron Pippin], which proved less hardy than the above cultivars, are nevertheless recommended for their high yield, late maturation and good keeping properties.

4328 Gilmer, R. M. & Einset, J.
**Some bud mutations of apple with virus-like symptoms.**
Plant Dis. Reptr. 1959 : **43** : 264–69.

Six fruit abnormalities of apple, four in Rhode Island Greening and one each in Northern Spy and McIntosh, are described. These have been shown to be bud mutations and not virus effects and are all commercially worthless.

4329 Ševčenko, V. A.
**(Training apple hybrids).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 120–21. [Russian].

Mention is made of hybrids bred and subjected to environmental training to improve their winter hardiness and the size and flavour of the fruit at Minusinsk. The results are seedlings 7–3–10 and 7–3–4, which are superior to the Siberian apple standards in all the above respects. The training consisted of giving young hybrid plants ample nourishment and moisture and grafting them before they came into bearing on to hardy, vigorous adult trees of unspecified apple hybrids.

4330 Milella, A.
Contributo allo studio delle cultivar sarde di melo "Appio" e "Miali". **(Contribution to the study of the Sardinian apple cultivars Appio and Miali).**
Riv. Ortoflorofruttic. ital. 1959 : **43** : 147–56.

After descriptions of the two cultivars, data are given on their date of flowering in relation to other cultivars, pollen germination and compatibility relationships. Both cultivars are self incompatible; they are intercompatible when pollinated artificially but in nature their flowering times do not coincide.

4331 **(The apple variety Vatutin).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 3 : p. 58. [Russian].

This variety was selected from seedlings of Antonovka Obyknovennaja [Common Antonovka] at Kujbyšev and is winter hardy and resistant to fungi. The fruits are large and have firm, yellow, juicy flesh of pleasant flavour. The variety ripens in September and keeps better than the parent variety.

4332 Iimori, M.
**(Fruit-tree trends and the selection of apple varieties).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1505–08. [Japanese].

A general survey of fruit-tree cultivation in Japan is followed by short descriptions of a series of recently bred or introduced apple varieties.

4333 **New apple variety.**
Amer. Fruit Gr. 1959 : **79** : No. 4 : p. 59.

Blaze, released by Illinois Agricultural Experimental Station, Urbana, will extend the fresh-market season for Jonathan-type apples, as it ripens three and a half weeks before Jonathan. The fruit is medium sized with yellowish, good-quality flesh, and has skin which is three-quarters red and a quarter bright yellow. It is moderately susceptible to apple scab (*Venturia inaequalis*) and cedar apple rust (*Gymnosporangium juniperi-virginianae*), is susceptible to black rot (*Xylaria mali*) and has shown moderate resistance to natural infection by apple blotch (*Phyllosticta solitaria*), powdery mildew (*Podosphaera leucotricha*) and fire blight (*Erwinia amylovora*).

4334 Hořavka, B.
Diferenciace květních pupenů jabloní. **(Differentiation of flower buds of apple trees).**
Čsl. Biol. 1957 : **6** : 462–65.

Twenty-two apple varieties were investigated and it was found that they fell into three groups according to the time of flower-bud development. Flower-bud differentiation occurred during 1–15 August in the first group and during 15–30 August and 1–15 September in the second and third groups respectively.

4335 Murawski, H.
Beiträge zur Züchtungsforschung beim Apfel. IV. Weitere Untersuchungen zur Züchtung von Apfelsorten mit spätem Laubaustrieb und Blühbeginn. **(Contributions to breeding research on the apple. IV. Further investigations on the breeding of apple varieties with late flushing and inception of flowering).**
Züchter 1959 : **29** : 72–78.

The results are reported of observations on the

flushing and time of flowering of seedlings of Spätblühender Taffetapfel [Late-blooming Taffeta apple] and crosses of another late variety, Königlicher Kurzstiel [Royal Short-stemmed]. These characters are genotypically determined and incompletely dominant. Many of the seedlings of Spätblühender Taffetapfel showed a close relationship between the time of flushing and the inception of flowering; seedlings differed in the effect that weather conditions had on their development.

4336 Tamás, P.
Über die Ursachen der Zusammenhänge zwischen Temperaturgestaltung und Aufblühdaten von Obstgehölzen sowie über die Temperaturempfindlichkeit der Pflanzen. (**On the causes of the relationships between temperature conditions and flowering dates of fruit trees and also on the sensitivity to temperature of plants**).
Züchter 1959 : **29** : 78–91.

It is thought that, under normal conditions, the only external factors influencing the time of flowering of fruit trees are the temperatures occurring during the year in which flowering occurs. Various formulae have been suggested relating these temperatures to the time of flowering; these formulae are now critically examined in relation to data obtained from observations made on a large collection of apple trees at Balsgård, Fjälkestad, Sweden. Herbst and Weger's formula is sufficiently accurate to make possible the forecasting of flowering times. However in some years the effect of weather conditions on time of flowering can not be explained with reference to the temperature-sum theory. The general formula for the relationship between a biological stage and the temperature conditions is $S_t = \Sigma a(t - \tau)$, where $a$ = the number of hourly temperature readings, $S_t$ = the sum of temperature required for the plant to reach the stage in question, $t$ = temperature and $\tau$ = the threshold temperature. At temperatures below the threshold value, the plant is inactive; the threshold value is a varietal character and a method of determining it is described. It is thought that it would be useful to determine the thermal reaction norms of plants; the information thus obtained would be valuable in breeding plants acclimatized to different habitats.

4337 Nybom, N.
**On the inheritance of acidity in cultivated apples.**
Hereditas, Lund 1959 : **45** : 332–50.

Investigations conducted at the Balsgård Fruit Breeding Institute, Fjälkestad, Sweden, revealed that cultivated varieties of apple fall into two groups according to their malic acid content; the acid group has a pH between 3 and 3·4 and the sweet group a pH of about 4. These observations were made on fresh apples during summer before the acid had started to break down in the later stages of ripening. Most varieties were found to belong to the acid group. Twenty-one different crosses were investigated and it was found that the variation in acidity is caused by a single Mendelian factor; in some cases there was a deficiency in the sweet recessives. The recessive gene for sweetness was found to be widespread among varieties although it is of little importance in the breeding of dessert apples; this gene may have been retained owing to some selective advantage of the gene in the heterozygous condition.
The leaf sap of sweet types usually had a pH of 5·7 compared with 5·5–5·6 for the acid ones, thus indicating a certain correlation between the acid contents of leaves and fruits.

4338 Naumov, V. A.
(**The mode of inheritance of parental characters in hybrid apple seedlings**).
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 5 : 20–24. [Russian].

The inheritance of the shape of fruits and leaves in a seedling family of Bergamotte Reinette x Bel'fler Želtyj [Yellow Bellflower] was studied at Mičurinsk, the parental forms differing greatly in respect of these characters. Biometrical data for 22 seedlings and the parent varieties are presented in tabular form. The results of analyses showed that most seedlings were characterized by great variability of an intermediate kind in respect of parental characteristics, though in the case of fruit characteristics the seedlings tended to shift more closely towards Bergamotte Reinette.

4339 Carlone, R.
Le specie del genere *Malus* (Miller) esistenti in Cina e loro utilizzazione in frutticoltura. (**The species of the genus *Malus* Miller existing in China and their use in horticulture**).
Ann. Accad. Agric. Torino 1956–1957 : **99** : 247–83.

Twenty species belonging to three of the five sections of Rehder, namely to *Eumalus*, *Sorbomalus* and *Docyniopsis*, are described, with indications of the uses to which they are put in

China and the areas in which they are grown. The only species that is not of Chinese origin is *M. pumila*, which was introduced several centuries ago and has now become, with *M. asiatica* and *M. micromalus*, one of the main species grown for fruit.

4340 Vasil'čenko, G. V.
**(Some characteristics of *Malus pallasiana* Juz. in the Altaj).**
Bot. Ž. (Bot. J.), Moskva 1959 : **44** : 113–15. [Russian].

A study of some 500 trees of the Siberian apple for their suitability for use as rootstocks showed a number of clear differences between the wild and cultivated forms. *M. baccata* is regarded as a hybrid of *M. pallasiana*.

4341 Vuorinen, J.
Maaperän merkityksestä omenapuiden talvenkestävyydelle. **(On the importance of edaphic factors with regard to the winter hardiness of apple trees).**
Agrogeol. Julk. 1958 : No. 69 : Pp. 32.

At attempt has been made to determine the influence of soil properties on winter resistance to apple trees, as distinct from other factors. Hardy varieties such as Antonovka, Kaneli and Snygg [Neat] show negligible variations according to soil properties. On a south-facing slope, a marked correlation between height and increased hardiness in sensitive varieties such as Lobo and Wealthy was noted. Varieties of intermediate hardiness such as Åkero, Melba and Rupert showed less correlation. Correlations in Wealthy and Lobo between hardiness and soil moisture and mineral constituents are also given.

4342 Brown, A. G.
**The inheritance of mildew resistance in progenies of the cultivated apple.**
Euphytica, Wageningen 1959 : **8** : 81–88.

Mildew resistance was assessed in 13 inbred and 51 hybrid families, a total of 31 parental varieties being used. The frequency distributions obtained indicated that resistance is quantitatively inherited and a statistical analysis employing methods applicable to an incomplete diallel cross showed that the parental contributions to the resistance of the progenies were highly consistent. Among the more extensively used parents, Beauty of Bath, Lord Lambourne, 855 and Exquisite were estimated to give the highest contributions towards resistance, while among parents used in only a few crosses, Kola, James Grieve, Dabinett and Annie Elizabeth appeared best. Merton Russet, Cox's Orange Pippin and some seedlings of the latter transmitted little or no resistance. The combinations tested revealed no reciprocal differences in resistance of the progeny. A positive correlation between actual parental resistance and estimated parental contribution in crosses was found in most cases. Variety 855 was exceptional in being itself susceptible yet contributing a high degree of resistance to its offspring.

4343 Kuc, J., Barnes, E., Daftsios, A. & Williams, E. B.
**The effect of amino acids on susceptibility of apple varieties to scab.**
Phytopathology 1959 : **49** : 313–15.

Golden Delicious, McIntosh, Jonared, Yellow Transparent and Gallia Beauty, all of which are susceptible to *Venturia inaequalis*, were infused with D- or DL-phenylalanine and then a conidial suspension of *V. inaequalis* races 1, 2 and 3. The infusion resulted in a reduction in their susceptibility but not in a resistant reaction. After infusion with D- or DL-phenylalanine selections of the Russian variety R12740–7A, susceptible to race 2 and resistant to races 1 and 3 of *V. inaequalis*, and selections of the variety Geneva, susceptible to race 3 and resistant to races 1 and 2, were found to be resistant to all three races.

4344 Keane, F. W. L. & Welsh, M. F.
**Virus stem pitting of apple body in stocks in British Columbia.**
Plant Dis. Reptr. 1959 : Suppl. 254 : 22–24.

Surveys indicate that the varieties Charlamoff, Haralson and Hibernal, which are used as stocks, are unaffected or only mildly affected by virus stem pitting.

4345 McCrum, R. C. & Hilborn, M. T.
**Observations in Maine on "stem pitting", a virus disease of apple.**
Plant Dis. Reptr. 1959 : Suppl. 254 : 3–7.

A preliminary investigation on the occurrence of stem pitting in apples has shown several stock varieties to be free from pitting in an experimental orchard where a much larger number were found to be pitted.

4346 Millikan, D. F. & Guengerich, H. W.
**Tolerance of some hardy apple stocks to the stem-pitting virus of apple.**
Plant Dis. Reptr. 1959 : Suppl. 254 : 35–36.

Experimental inoculations at the Missouri Agricultural Experimental Station of a number of clones showed that 12 out of a total of 24 exhibited no symptoms of stem pitting; of these

*M. kitaika* 'P1107219', K-14, K-18, Columbia and Charlamoff remained free of pitting for 3 years after inoculation.

4347 Mink, G. I. & Shay, J. R.
**A survey for stem pitting in Indiana apple varieties.**
Plant Dis. Reptr. 1959 : Suppl. 254 : 18–21.

A visual survey for incidence of stem pitting symptoms is described. Of the varieties of mature trees examined, only Stayman Winesap was found to be free of disease. In a similar survey of seedling trees no varieties were found to be immune though maximum resistance was found in Starking x *Malus baccata* var. *jackii* where only 16% showed symptoms. It was found that some trees showing no symptoms induced them in indicator hosts.

4348 Žavoronkov, P. A.
**(Breeding winter-hardy pear varieties in the south Urals).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 80–86. [Russian].

This account of interspecific hybridization at the Čeljabinsk Horticultural Research Station mentions hybrids with fine-quality fruit which are winter hardy in the Urals. They were obtained by pollinating *Pyrus ussuriensis* forms with Williams, Clapp's Favourite, Lesnaja Krasavica [Forest Beauty] and other southern European or central Russian cultivars.

4349 Bambukov, P.
**(Cerovka).**
Selskostopan. Misăl 1958 : **3** : 509–16. [Bulgarian].

A description is given of the local pear Cerovka [pear from Cerova Korija], characterized by earliness, high quality fruit with a pleasant aroma, winter hardiness, resistance to drought and good cropping capacity. It is regarded as valuable for breeding early varieties and has been used as a parent in hybridization work at the Drjanovo Fruit Research Station. Many hybrids have reached the fruiting stage and are under observation.

4350 Gosenčenko, G. I.
**(The varieties of pear in the Amur province).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : 50–56. [Russian].

Six seedling selections of *Pyrus amuriensis* from the Agricultural Research Station for the Amur province are described. All are winter hardy and produce fruit of fair quality. The maturation dates range from August to October, Amurskaja Rannjaja [Amur Early] and Amurskaja Sladkaja [Amur Sweet] being the earliest among them. Amurskaja Pozdnjaja [Amur Late] has the largest fruit, the average weight being 50–80 g. Some seedlings of *P. ussuriensis* have been crossed with the Far Eastern cultivar Tema and some Crimean cultivars and hardy seedlings from crosses are now under observation.

4351 Inoue, S. & Fujiwara, Y.
**(Investigations on pear stocks. I. On variation in the osmotic pressure of seedling progenies obtained by open pollination of *Pyrus betulaefolia* Bunge).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 791–92. [Japanese].

The osmotic pressures found in the above seedlings ranged from below 0·55 to 0·65 mol., most of the seedlings having low values.

4352 Wagenbreth, A.
Das Vorkommen zweier Flavonoidgarnituren in der Gattung *Pyrus*. **(The occurrence of two sets of flavonoid material in the genus *Pyrus*).**
Flora, Jena 1959 : **147** : 164–66.

Some 20 species fell into two groups on the basis of the flavonoid compounds present in the leaves as detected by means of paper chromatography. In group I hyperin forms the chief flavonol and each species may contain up to five out of a total of six additional flavonol glycosides in varying quantities and combinations; three of these appear to be quercetin derivatives. In the group II, in addition to the substances found in group I, five further compounds occur. Group I comprises largely western species with a persistent calyx, group II Far Eastern species with a deciduous calyx. The exceptional species include *P. ussuriensis*, an eastern variety with a persistent calyx, belonging to group II, and *P. longipes*, an Algerian species with a deciduous calyx belonging to group I.

4353 Inoue, S. & Fujiwara, Y.
**(Investigations on damage to pears brought about by cold. II. On the changes in buds injured by cold and alterations in state of health).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 641–42. [Japanese].

Data are provided on the incidence and type of injury caused by low spring temperatures to a series of Japanese and introduced varieties in Kyoto.

4354 Rabanová, L'.
Diferenciácia a vývin kvetných pupeňov marhule. (**Differentiation and development of flower buds in the apricot**).
Pol'nohospodárstvo 1959 : **6** : 193–212.
Information is provided on flower development in four apricot varieties studied in several districts in Czechoslovakia. The time of differentiation of the flower primordia, which is a varietal character, was greatly influenced by the environment.

4355 Tupicyn, D. I. & Tataurova, A. S.
**(The frost resistance of ripening apricots).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : 56–57. [Russian].
European and Central Asiatic cultivars which were found to be the most tolerant of spring frost in the province of Taškent are named. The European varieties were generally more resistant than oriental varieties or hybrids between the European and oriental apricots.

4356 Nyland, G. & Thomas, H. E.
**A new strain of ring pox virus in Royal apricot.**
Phytopathology 1959 : **49** : 338–39.
A graft-transmissible disease that has been reported on Royal apricot, with leaf, fruit and sometimes petiole symptoms, resembles apricot ring pox. The disease was more severe in Royal than in Tilton. The fruit symptoms were milder and more superficial than the symptoms of typical apricot ring pox. However, the resemblance to apricot ring pox suggests that this disease may be caused by a new strain of ring-pox virus that is capable of inducing symptoms on Royal.

4357 Enikeev, H. K.
Aplicarea metodelor Miciuriniste pentru crearea noilor soiuri de prun în zona de nord şi cea mijlocie a Uniunii Sovietice. (**The application of Mičurinist methods for producing new plum varieties for the northern and central zones of the Soviet Union**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 121–41.
[Cf. XXVI, 1732].

4358 Kordon, R.
**[An eminent horticultural scientist. (On the occasion of the 90th birthday of F. A. Krjukov)].**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 4 : p. 78. [Russian].
Mention is made of plum varieties bred by Krjukov; Rodina [Fatherland], Jantarnaja [Amber], Pavlovskaja Krasavica [Pavlovsk Beauty], Jubilejnaja [Jubilee], Renklod Severnyj [Northern Gage] and Izumitel'naja [Amazing] are now being tested in the northwestern zone of the RSFSR.

4359 Ven'jaminov, A. N.
**(Fertile hybrids between *Prunus domestica* and oriental plum species).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 68–72. [Russian].
This report on breeding plums for winter hardiness deals with interspecific hybridization and the methods employed to obtain fertile hybrids at the Mičurin Horticultural Institute. Among fertile hybrids combining winter hardiness with fine quality are those of *P. insititia* x *P. domestica* and *P. americana* x *P. domestica*, the latter obtained by open pollination. In addition to these the multiple hybrids Eurasia 1, 2 and 3 were obtained by fertilizing a hybrid of *P. salicina* x *P. americana* with a pollen mixture of three *P. domestica* varieties and using the resulting hybrid 15/18 as a pollen parent for the plum cultivar Očakovskaja Želtaja [Yellow Očakov]. The hybrid from the final cross was budded on *P. domestica*. Hybrid 15/18 is also regarded as a valuable pollen parent for crossing with *P. americana*, *P. ussuriensis* and other *P. domestica* cultivars besides Očakovskaja Želtaja; in the reciprocal crosses with the above species hybrid 15/18 is sterile. Mention is made of a hybrid of *P. domestica* with *P. ussuriensis* interesting for its winter hardiness and high degree of fertility but having small fruits of indifferent quality and therefore having no immediate value except as breeding material for crossing with plum, myrobalan, damson and sloe.

4360 Enikeev, H. K.
**(A description of the propagation of new fruit tree varieties in connexion with tissue heterogeneity).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 38–48. [Russian].
Observations on plums at Mičurinsk showed that recent hybrids are more heterogeneous than old established cultivars. This accounts for their giving rise more frequently to mutations showing variations in yield, winter hardiness and size and sugar content of the fruit. Some own-rooted seedlings of the new varieties show continued annual improvement in these respects. Impairments in the above characteristics, observed in some new varieties which have been propagated vegetatively, are associated

with the heterogeneity of tissues of scions taken from different portions of the tree.

4361 Murawski, H.
Beiträge zur Züchtungsforschung an Pflaumen. II. Weitere Untersuchungen über den züchterischen Wert von Sämlingen der Kirschpflaume, *Prunus cerasifera* Ehrh. (**Contributions to breeding research on plums. II. Further investigations on the breeding value of seedlings of the cherry plum *P. cerasifera* Ehrh.**).
Züchter 1959 : **29** : 21–36.

The results are reported of morphological and pomological studies carried out at Müncheberg with seedlings of *P. cerasifera* originating from crosses and selfs effected in 1934 and 1936; the material included two autotetraploid seedlings [cf. XXIV, 2382]. All characters investigated showed considerable variation in the progenies; even within self progenies there was considerable segregation. This indicates that *P. cerasifera* is strongly heterozygous. Some of the most marked variation was found in fruit form, the weight of 100 fruits varying between 690 g. and 4561 g. The largest fruits were produced by one of the polyploid seedlings. Fruit colour ranged between yellow and wine red. A tree with reddish violet fruit gave on selfing two seedlings with yellow fruit, one with greenish yellow fruit and one with reddish violet fruit. The stones of the polyploid fruits were considerably larger than those of the diploid fruits. The average proportion of stone in diploid fruit was about 3·68% whilst that of tetraploid fruit was 36·72%. Fruits of seven seedlings were tested and found to be suitable for making jam; the two best seedlings are particularly suitable for household use. Three seedlings with the names Ceres, Anatolia and Fertilia have been added to the official variety list of the German Democratic Republic.
Observations were also made on the time of opening of the leaf buds, flowering, fruit ripening, colouring of the leaves and leaf fall. Weather conditions affected the development of the seedlings and there appeared to be genotypic differences in reaction to weather. The tetraploid seedlings developed more quickly than the diploids. Phenological observations made on seedlings of *P. cerasifera* in Turkey were compared with those made at Müncheberg; differences in the developmental cycle were related to climatic differences between the two countries. The high susceptibility to frost shown by some of the seedlings in Müncheberg was partly the result of insufficient selection for frost resistance in their land of origin, Turkey, and partly due to poor adaptation to the Müncheberg climate. However a few of the seedlings showed some resistance to frost and it should be possible to improve the frost resistance of *P. cerasifera* by selection. On the whole the diploids were less frost resistant than the tetraploids.
Differences were also noted between seedlings in respect of the rooting capacity of cuttings. One tetraploid seedling showed a good rooting capacity and good stem building properties.

4362 Krümmel, H.
Zur Sortenklärung bei den Sauerkirschen 'Königliche Amarelle', 'Diemitzer Amarelle', 'Ludwigs Frühe' und 'Werdersche Glaskirsche'. (**Clarification of varieties in the sour cherries Königliche Amarelle, Diemitzer Amarelle, Ludwigs Frühe and Werdersche Glaskirsche**).
Dtsch. Gartenbau 1959 : **6** : 83–85.

Important horticultural characters of these amarelle varieties are compared and the origins of the varieties are discussed. Of the four varieties, Werdersche Glaskirsche is most highly recommended; it has large fruit of good flavour and is of high productivity, being completely self fertile.

4363 Scaramuzzi, F.
Contributo allo studio delle cultivar locali italiane di ciliegio acido. (**Contribution to the study of the local Italian cultivars of sour cherry**).
Riv. Ortoflorofruttic. ital. 1959 : **43** : 120–46.

The descriptions are continued [cf. 3038]. Three cultivars, Zara A, Pescara and Verona, ripen at Florence before the middle of June, Verona being distinguished by large fruits and Pescara by high sugar content.

4364 Komarnickaja, A. M. & Padalica, G. (**Studying and testing sour cherry varieties**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : 53–55. [Russian].

The first author describes how Mokanisit Pastuš, Krišana and Griotte 3 have been selected for their high yields, winter hardiness and large sweet fruit from a collection in the Botanic Garden of the Ukrainian Academy of Sciences. The first two originated from Rumania and appear to be hybrids between sweet and sour cherry; in quality they are superior to such varieties as Španka Rannjaja [Early Španka],

and Krišana is also early. Griotte 3 equals the sour cherry Anadol'skaja in quality and yield but exceeds it in winter hardiness. The fruit is not quite so sweet and large as that of the other two varieties.

Ten varieties which have been found winter-hardy, drought resistant and productive of fine quality fruit in recent trials carried out in the Don Basin are listed by the second author. These include Ukrainka [sour cherry from the Ukraine], which has been bred in recent years at Melitopol'.

4365 Efimov, V. A.
**(The sequence of flowering of different species and varieties of sour cherry and plum).**
Izv. Timirjazev. sel'skohozjajstv. Akad. (News Timirjazev agric. Acad.) 1959 : No. 1 : 165–74. [Russian].

Data on flowering, collected during the period from 1932 to 1955 in the provinces of Moscow and Vladimir, are presented in tabular form. Varieties characterized by early, midearly, midlate or late flowering are listed, the early *Prunus domestica* varieties comprising Očakovskaja Černaja [Black Očakov], Renklod Kolhoznyi [Kolhoz Gage] and Skorospelka Krasnaja [Early Red], and the early cherries comprising Ostheim Griotte, Skljanka Rozovaja [Pink Glass] and Ijun'skaja [June].

4366 Fogle, H. W.
**Inheritance of fruit color in sweet cherries (*Prunus avium*).**
J. Hered. 1958 : **49** : 294–98.

The inheritance of skin and flesh colour was studied in 1227 seedlings from 15 variety crosses. Napoleon, a white-fleshed variety with a pink blush, and Bing, a red-fleshed mahogany-skinned variety, were the female parents and red-fleshed mahogany varieties the pollen parents. Flesh colour segregations gave red: white ratios of approximately 1 : 1 for Napoleon crosses and 3 : 1 for Bing crosses, suggesting the probability that monohybrid segregation was operative. Skin colour gave red : white ratios of approximately 7 : 1 in the Napoleon crosses and 15 : 1 in the Bing crosses, indicating incomplete dominant epistasis. It is suggested that a major factor, identical with or very closely linked to the flesh-colour factor, and an additional minor factor control skin colour; both appear to be incompletely dominant. The major factor was apparently necessary for the production of mahogany colour and the minor one for darkening the shade. Alone in the heterozygous condition, this minor factor appeared to produce pink blush and when homozygous dominant it produced a light red skin colour. The lack of complete dominance of both factors appeared to make each genotype essentially a separate phenotype. In practice it was difficult to classify the mahogany phenotypes precisely because of the interference of differences in maturity at the time of evaluation.

4367 Morris, H. F.
**Performance of peach varieties in east Texas.**
Bull. Tex. agric. Exp. Sta. 1958 : No. B–913 : Pp. 36.

Descriptive tables and notes are given on the performance, cold requirements, growth rhythm, cropping capacity and fruit characters of most of the new varieties and some older ones tested at Tyler Station during the period 1947 to 1959. Varieties suitable for cultivation in eastern Texas are listed.

4368 de Wet, A. F.
**The canning peach: Simonsberg.**
Dec. Fruit Gr. 1957 : **7** : 292–93.

Simonsberg is a seedling of Kakamas. It yields slightly less fruit than the latter but the number of fruits in the larger grades is higher. It is 5–7 days later than its parent.

4369 Sato, K.
**(Areas suitable for the cultivation of canning-peach varieties and attention to their cultivation).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 745–48. [Japanese].

Descriptions are included of four canning varieties referred to elsewhere [XXIX, 674] and of a fifth, Myojo [Venus], a selection of Yamashita x Shimusu.

4370 Wagnon, H. K., Dobbins, G. C. & Breece, J. R.
**The use of foliar gland characters in the identification of peach and nectarine varieties in California.**
Bull. Calif. Dep. Agric. 1959 : **48** : 24–31.

The use of foliar glands on the petioles and basal margins of the leaf as a means of varietal identification is discussed and a list is given indicating the gland types to which 469 peach and nectarine varieties belong.

4371 **No frosted peaches ?**
Amer. Fruit Gr. 1959 : **79** : No. 4 : 43, 46.

At North Louisiana Experimental Station, Calhoun, a study of irrigation as a means of protecting peach trees against frost damage is being made. Of the 17 varieties tested for resistance to frost with irrigation, Fireglow was superior with 100% live fruit and Blazing Glow

suffered the greatest damage with 50%. Non irrigated trees of Fireglow had only 24% of live fruit and Blazing Glow had only 8%.

4372 Resnik, M. E.
Fisiología y longevidad del polen en los citrus. **(Physiology and longevity of citrus pollen).**
Rev. Invest. agríc., B. Aires 1958 : **12** : 311–43.

The studies reported below were carried out on one or more of the following species and varieties: the orange Shamuti, the pomelo Marsh Seedless, the tangor Temple, the lemons Meyer and Eureka, *Poncirus trifoliata* and *Fortunella* sp. Malformed inviable pollen grains were frequent, the average value for Shamuti being 32%. Varietal differences in optimum sucrose concentration of the germination solution were found. Germination was stimulated by thiamin, boric acid and indole-3-butyric acid. Optimum germination occurred at 25° C. in Eureka. In *Fortunella* a maximum germination of 25–30% was reached after about 20 hr. Staining was an ineffective method of determining viability. Pollen of *P. trifoliata* retained its viability for 12 days in the shade and for nine in the sun. *Fortunella* pollen was viable after ten weeks' storage at — 6° C. under conditions of low humidity in the presence of $CaCl_2$; where $H_2SO_4$ was used as desiccating agent, viability was zero after eight weeks at — 6° C.

4373 McCown, J. T.
**Field observations of Florida citrus following the 1957–58 freezes.**
Proc. Fla. hort. Soc. 1958 : **71** : 152–57.

Different orange varieties differed in their tolerance of frost and in their ability to recover from its effects. Jaffa, followed by Florida sweet seedling, Valencia, Parson Brown, Hamlin and Pineapple were the most frost-resistant varieties. Valencia recovered more quickly than the other varieties after frost injury. The hardiest grapefruit variety appears to be Duncan. The pink and red-fleshed varieties seem to suffer more severely than the white-fleshed varieties.

4374 Calcagnolo, G.
Os laranjais paulistas estão sendo prejudicados pelo ataque de mais uma espécie de ácaro. **(The oranges of São Paulo are being damaged by another species of mite).**
Biológico 1959 : **25** : 33–38.

Varietal differences in infestation by *Hemitarsonemus latus* are noted, the variety least affected being Valencia.

4375 Calavan, E. C., Soost, R. K. & Cameron, J. W.
**Exocortis-like symptoms on unbudded seedlings and rootstocks of *Poncirus trifoliata* with seedling-line tops, and probable spread of exocortis in a nursery.**
Plant Dis. Reptr. 1959 : **43** : 374–79.

The occurrence of abnormal cracking and necrosis of bark tissues in seedlings and rootstocks of diploid *Poncirus trifoliata* at Riverside, Calif., is described. This is regarded as probably genetic in origin and does not occur in tetraploid rootstocks.

4376 Yakushiji, K.
**(The cultivation and management of citrus fruits. I, II).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 83–88, 413–16. [Japanese].

A survey is given of the principal Japanese strains of the Unshu ( = Satsuma) mandarin, classified according to ripening date.

4377 Krezdorn, A. H. & Robinson, F. A.
**Unfruitfulness in the Orlando tangelo.**
Proc. Fla. hort. Soc. 1958 : **71** : 86–91.

Unfruitfulness in the Orlando tangelo, a hybrid of Bowen grapefruit with Dancy tangerine, is due to a combination of sexual self-incompatibility and the lack of strong, consistent parthenocarpy. Hand cross pollination resulted in an increase in fruiting. Some of the pollen varieties which effectively induced fruiting when used in hand crosses were either partially or totally ineffective under field conditions of open pollination. Where blocks of Orlando trees failed to develop fruit when selfed, cross pollination with the appropriate pollen variety, Temple or Dancy, increased yields.

**Finding the best lemon for Florida—A report of progress.**
Proc. Fla. hort. Soc. 1958 : **71** : 123–46.

4378 *Knorr, L. C. I. The growing of lemons in Florida: historical, varietal, and cultural considerations. (pp. 123–28).*

In the redevelopment of the lemon industry of Florida, chiefly for frozen concentrated citrus juice, varieties already in the State, with a high yield of fruit and of acid per acre, good quality peel oil, cold and disease resistance and failure to develop thorns, have been selected for trials. Of these selections, 40 have yielded their first crop which was tested together with two other varieties for yield of juice, acid content in juice, flavour of juice, fruit size, number of seeds and segments and quality of peel oil.

Other properties of the trees have also been noted. It is still too early to recommend varieties for planting though some have already proved to be unsuitable.

4379 *Wenzel, F. W., Olsen, R. W., Barron, R. W., Huggart, R. L. & Hill, E. C. II. Use of Florida lemons in frozen concentrate for lemonade.* (*pp. 129–32*).

Two important factors in the production of lemons for use in processed lemon products are flavour and yield of acid. Of the 42 selections tested, 40 had a typical lemon flavour with no off-flavours.

4380 *Kesterson, J. W. & Hendrickson, R. III. Evaluation of coldpressed Florida lemon oil and lemon bioflavonoids.* (*pp. 132–40*).

The physical and chemical properties of samples of cold-pressed lemon oil prepared from 42 selections are tabulated. Quality of the oil appears to be correlated in part with the yield of oil obtained. Certain of the selections give a high quality oil. The bioflavonoid content of the 42 selections was investigated; it consists largely of hesperidin.

4381 *Grierson, W. IV. Florida lemons for fresh fruit use.* (*pp. 140–44*).

Lemons for fresh fruit are not likely to be of great importance. However lemons from certain selections, especially those from two Bearss selections, nos. 8 and 11, proved capable of being cured to form an acceptable fresh fruit. Comments on colour, texture, amount of decay during curing and peel injury on certain of the selections are given.

4382 *Reitz, H. J. V. General conclusions regarding the best lemon for Florida.* (*pp. 144–46*).

In discussing the characteristics of the lemon strains suited to Florida, reference is made to the data and conclusions in the preceeding papers [4378–81].

4383 Knorr, L. C.
**Another pot of gold for Florida ?**
Amer. Fruit Gr. 1959 : **79** : No. 4 : 12, 54–55.

The development of the lemon industry of Florida and breeding new varieties for processing are discussed. [Cf. 4378–82].

4384 Kolelišvili, M. V.
**(The importance of the mentor in lemon breeding).**
Agrobiologija (Agrobiology) 1958 : No. 4 : 73–79. [Russian].

Breeding lemons for winter hardiness at Suhumi is discussed with emphasis on the value of training hybrids on *Poncirus trifoliata* stocks or in the crown of an adult tree of Unshu (=Satsuma) mandarin or another citrus cultivar. The former method is used to improve the winter hardiness of intraspecific lemon hybrids having fruits of moderate quality, while the latter is chiefly intended for improvement of fruit quality of interspecific hybrids of lemons with such wild winter-hardy species as *Citrus ichangensis, C. junos* or *C. wilsonii.*

4385 Jarrett, F. M.
**A revision of *Artocarpus* and allied genera.**
Abstr. Diss. Univ. Camb. 1956–57 (1959) : 20–21. (Abst.).

A revision of *Artocarpus, Prainea, Pararto-carpus* and *Hullettia* is presented. Fifty species of *Artocarpus* are recognized; they fall into two groups as regards distribution, some being represented throughout Malaysia and in Ceylon and southern India and others being restricted to the western part of Malaysia.

4386 Carmichael, W. W.
**Observations of cold damage to mangos in Dade county and the lower west coast.**
Proc. Fla. hort. Soc. 1958 : **71** : 333–35.

Young mango trees are susceptible to temperatures below 31° F. for more than two hours. The heavy frost of February 1958 proved conclusively the variation of cold susceptibility between varieties. Keitt appears to be the most susceptible variety with Palmer, Lippens, Irwin, Springfels and Brooks only slightly less so. Highest resistance is shown by Kent, Sensation, Dixon, Smith and Haden. Irwin and Lippens appear to recover most rapidly.

4387 **Two new pecan varieties released.**
Tex. Pecan News 1959 : No. 4 : 2–3.

Choctaw (Success x Mahan) and Wichita (Halbert x Mahan) have been released by the US Pecan Field Station, Brownwood, Tex. Both varieties have all-round good qualities. About 45 nuts of Choctaw and about 60 of Wichita are required to make up a pound, with a kernel percentage of 60 in each variety.

4388 Solignat, G.
Observations sur la biologie du châtaignier. **(Observations on the biology of the chestnut).**
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 31–58.

The results are reported of studies carried out at the Chestnut Breeding Station, Brive, on the floral biology and reproductive cycle of the

chestnut; the trees observed included some interspecific hybrids. Instances of sterility resulting from lack of pollen or the production of pollen of poor quality are recorded; also some trees were found to be female sterile. In general self compatibility was of a low order, most seed being produced by cross fertilization. Instances of cross incompatibility within species and between species were noted; in some cases this is thought to be due to the action of incompatibility alleles. Cross fertilization also failed when the pollen and stigmas matured at different times.

4389 Džiaukštas, P.
Riešutinio lazdyno formos Lietuvos TSR miškuose. **(Form variation of the hazel in the woods of the Lithuanian SSR).**
Lietuv. Mišk. Ūk. moksl. tyrim. Inst. Darb. 1958 : **3** : 139–53.
Forms with round and elongated nuts occur, together with a great range of intermediates, the round nuts having a higher kernel percentage; a number of these types have been selected.
A number of different types have also been established on the basis of leaf form.

4390 Karle, H. P. & Nyland, G.
**Yellow bud mosaic virus in almond.**
Plant Dis. Reptr. 1959 : **43** : 520–21.
Observations in California indicate a greater severity of disease in the variety Texas than in Nonpareil or Ne Plus. Trees where Mariana 26–24 was used as rootstock showed no symptoms.

4391 Kumar, L. S. S., & D'Cruz, R.
**Chemical composition of the allopolyploid groundnut (*Arachis hypogaea*).**
Indian Oilseeds J. 1959 : **3** : No. 2 : 91–94.
The oil percentages of Spanish Improved and allopolyploid *A. hypogaea* ($2n = 40$) x *A. villosa* ($2n = 20$) [cf. XXVII, 4425] were similar, being about 47%. The allopolyploid had a higher protein content, suggesting that it has a correspondingly lower starch content and higher oil/starch ratio than Spanish Improved.

4392 Katayama, Y. & Nagatomo, T.
**(Comparison of the oil content of groundnuts at different stages and the connexion with habit and variety).**
Miyazaki Daigaku Nogakubu Kenkyu Jiho/Bull. Fac. Agric. Univ. Miyazaki 1958 : **3** : Nos. 1–2 : 61–68. [Japanese].
A collection of 33 varieties, classified into four groups according to habit and seed size, was studied. Water and oil content of the seed was studied after sowing and during maturation. After sowing, oil content declined but there was little differential effect associated with habit or seed size. Oil content at full maturity was little affected by habit or seed size either, but, in the earlier stage of seed development, oil content was higher in small-seeded varieties.

4393 Katayama, Y. & Nagatomo, T.
**(Modification and alteration in the development of groundnut habit).**
Miyazaki Daigaku Nogakubu Kenkyu Jiho/Bull. Fac. Agric. Univ. Miyazaki 1958 : **3** : Nos. 1–2 : 69–76. [Japanese].
Using varieties pertaining to the same four varietal groups as in the preceding abstract, data were obtained on the effect of dense planting, mixed sowing with a variety of different habit and treatment with MH–30 solution on the growth of the main stems and lateral branches.

4394 Gopinathan Nair, R.
**Heteropollination in the improvement of coconuts.**
Cocon. Bull. 1959 : **12** : 436–37, 442.
After briefly reviewing results obtained from multiparental pollination of crops, as reported from the USSR, the author suggests that this method may prove to be valuable in coconut breeding and states that a study of the effects of such pollination has been initiated at the Central Coconut Research Station, Kasaragod, India.

4395 Milella, A.
Contributo allo studio delle cultivar sarde di olivo. 1. Indagini condotte in provincia di Sassari. **(Contributions to the study of the Sardinian cultivars of olive. 1. Investigations made in the province of Sassari).**
Stud. sassaresi : Sez. III : 1957 : **5** : 40–67.
A study of the olives of the province has shown most of them to belong to the two cultivars Tondo [Round] and Palma; three others, Olivastrino, Corsicano and Sivigliano da olio [Seville oil olive], occur in smaller quantities and are also described. The most abundant pollen production was observed in Corsicano; though this variety had the highest percentage of abortive ovules it was the only one that displayed a certain degree of self compatibility. Suitable pollinators for each variety are indicated.

4396 Purss, G. S.
**Studies of the resistance of species of *Passiflora* to Fusarium wilt (*F. oxysporum* f. *passiflorae*).**
Qd. J. agric. Sci. 1958 : **15** : 95–99; and Bull. Dep. Agric. Qd. 1958 : No. 122 : Pp. 5.

Tests for resistance to *F. oxysporum* f. *passiflorae* were made on seed of *P. edulis* collected from ten different localities. The roots of the young seedlings were washed and dipped into an inoculum made by scraping spores and mycelium from the surface of a potato dextrose agar culture and putting them in a small quantity of water; the seedlings were then replanted. The resistance encountered proved to be of a low order, tending only to delay symptoms of the disease. Such resistance is of no value commercially. However, providing it is economical, it appears that control can be achieved by grafting *P. edulis* on to resistant *P. edulis* f. *flavicarpa*.

4397 Jiménez, H. & Horovitz, S.
Cruzabilidad entre especies de *Carica*. (**Crossability between *Carica* species**).
Agron. trop., Venezuela 1958 : **7** : 207–15.

When tested for interspecific cross compatibility, six species fell into the following three groups: (1) containing those which yielded viable seeds when crossed with one another, namely *C. monoica, C. cauliflora, C. microcarpa* and *C. candamarcensis*; (2) containing *C. papaya* only, which crossed with species in group 1 but did not form mature seed, although the immature embryos could usually be cultivated; and (3) with *C. goudotiana* only, which was interfertile with some species in group 1, giving embryos which could be cultivated, but was cross sterile with *C. papaya*. *C. monoica* confers vigour on the embryos and seedlings of its hybrids; *C. candamarcensis* hybrids are characterized by pubescence of the young stems and petioles, angular stems and anthocyanin pigmentation of the leaf veins; *C. goudotiana* transmits intense anthocyanin coloration; and pollen of *C. microcarpa* stimulates fruit development in the mother plant.

4398 Aiyappa, K. M., & Nanajappa, P. P.
**New varieties of fruit plants in Coorg.**
Mysore agric. J. 1958 : **33** : 160–61.

Coorg Honey, a new variety of papaya, comes into bearing within a year. It produces fruit throughout the year, each tree yielding 30 to 40 fruits weighing between 90 to 120 lbs. in all. Those fruits harvested from June to November are smaller in size, sweeter to taste and almost seedless. Unlike most other papaya varieties, it does not have an undesirable odour.

4399 Campbell, C. W.
**Report of the subtropical fruit variety committee, 1958. Part I.**
Proc. Fla. hort. Soc. 1958 : **71** : 365–66.

Gossman is a new avocado variety which fruits in January, February and March. The tree is upright in habit with fairly dense foliage and has borne a heavy crop consistently for the last few years. The fruit, which is oblong to slightly neck-shaped, has a dark green colour with a rough pebbly skin and an average weight of about 20 ounces. The flesh has a good texture and flavour. It has possible value as a late variety.

4400 Whelchel, H.
**Report of the subtropical fruit variety committee, 1958. Part II.**
Proc. Fla. hort. Soc. 1958 : **71** : 366–67.

Growers and shippers consider that Waldin's Booth Eight, Lula, Taylor, Pollock, Booth Seven and Hall varieties of avocado are best suited for commercial use with respect to production, size, storage, refrigeration, handling, shelf life, cold hardiness and consumer acceptance.

4401 Pennock, W.
**The testing and scoring of some avocado varieties and new selections on their behavior under refrigeration.**
J. Agric. Univ. PR 1959 : **43** : 34–49.

An account is given of a method of obtaining a refrigeration-tolerance index and of the application of the method in testing over 30 standard varieties and local selections. Marked varietal disparities in tolerance were found.

4402 Krome, W. H.
**Observations on cold damage to avocados in Dade County.**
Proc. Fla. hort. Soc. 1958 : **71** : 338–41.

Observations, particularly during February 1958, are recorded. Lula and Taylor proved to be more resistant to cold than most varieties while Booth Eight proved to be very susceptible.

4403 Cooper, W. C., Peynado, A., Maxwell, N. & Otey, G.
**Salt-tolerance and cold-hardiness tests on avocado trees.**
J. Rio Grande Valley Hort. Soc. 1957 : **11** : 67–74.

Six varieties were tested under laboratory conditions. Lula was most resistant to salinity

and the Mexican-West Indian hybrid Arsola 1–18 most resistant to cold.

4404 Davis, W. H.
**Apomixis, hybridization, and speciation in Rubus.**
Castanea 1958 : **23** : 52–55.

The variation and nomenclatural problems resulting from interspecific hybridization and apomixis in *Rubus* are discussed briefly and a plea for more detailed study of the wide range of forms in North America is put forward.

4405 Wierszyłłowski, J., Rusek, Z., Wituszyński, Z., Charłampowicz, Z. & Walczak, H.
Wartość produkcyjna i technologiczna 10 odmian malin w początkowym okresie owocowania plantacji. (**The productive and technological value of 10 raspberry varieties in the first fruiting period of the plantation**).
Roczn. Nauk rol. : Ser. A. : 1957 : **77** : 131–59.

A brief account of this work has already been summarized from another source [636].

4406 Iets over frambozenrassen. (**Something about raspberry varieties**).
Fruitteelt 1959 : **49** : p. 95.

Data on the performance of 12 varieties tested at Wilhelminadorp, Netherlands, are given. Malling Promise gave the highest yield.

4407 Petrahilev, I. M.
(**Raspberry hybrids obtained by means of distant hybridization**).
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 7 : 146–49. [Russian].

[Cf. 709].

4408 Leemans, J. A. & Nannenga, E. T.
**A morphological classification of raspberry varieties.**
Rasbeschrijv. Inst. Vered. TuinbGew., Wageningen 1957 : No. 2 : Pp. 140.

Descriptions are given of the principal varieties grown in the Netherlands, the features considered being plant habit and cane, spine, leaf, flower and fruit characters. A key to the varieties is included.

4409 Oleksiak, W., Wiśniewska, J., & Jaumień, F.
Uszkodzenia mrozowe 10 odmian malin w zimie roku 1955–1956. (**Frost damage in 10 raspberry varieties in the winter of 1955–1956**).
Prace Inst. Sadownict. Skierniewicach 1958 : **3** : 83–90.

In the trials at Świerklaniec, Poland, all the varieties tested showed some injury from winter frost. Malling Seedling was the most resistant.

4410 Bauer.
Abstammung der Johannisbeeren u. Stachelbeeren. (**The origin of currants and gooseberries**).
Dtsch. Baumsch. 1957 : **9** : 280–87.

The evolutionary history of cultivated *Ribes* varieties is outlined and descriptions are given of *R. sativum, R. rubrum, R. petraeum, R. multiflorum, R. alpinum, R. orientale, R. nigrum, R. floridum, R. sanguineum, R. glutinosum, R. aureum, R. grossularia, R. hirtellum, R. divaricatum* and *R. succirubrum* (*R. niveum* x *R. divaricatum*). The characters, in particular disease resistance, which are of interest to breeders are indicated.

4411 Puhtinskij, Ju.
(**Fruit species in the protective forest belts**).
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : p. 38. [Russian].

Mention is made of new red and black currant varieties from Rossoš' which are recommended for growing in the forest belts with poplar and other quick-growing forest trees or in orchards. They are characterized by good flavour and various maturation dates.

4412 Žitneva, P. I.
(**Reversion in black currant**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 4 : 61–63. [Russian].

Varietal differences of black currants in resistance to *Eriophyes* and currant reversion virus were observed at the Horticultural Research Station of the Timirjazev Agricultural Academy. Varieties resistant to both included Uspeh [Success] and Podmoskovskaja [Moscow Suburban], two new varieties bred at the above research station, also the cultivars Blestjaščaja [Glossy], Želannaja [Wish] and Perspectivnaja [Promising].

4413 Heggli, M.
Sortsgransking i stikkelsbær. (**Varietal studies in the gooseberry**).
Frukt og Bær 1958 : **11** : 46–53.

Collection and identification of varieties from Norway, Sweden, Denmark, Germany, Holland and England are in progress in Norway. Descriptions of 34 varieties of which authentic material is available are given.

4414 Brauns, M.
Beitrag zur Züchtung mehltauresistenter Stachelbeeren. I. Untersuchungen über die Vererbung der Resistenz und die Anwendungsmöglichkeiten der Frühselektion. **(A contribution to the breeding of mildew-resistant gooseberries. I. Investigations on the inheritance of resistance and the possibilities of using early selection).**
Züchter 1959 : **29** : 51–57.

At Müncheberg, diallel crosses were effected between four clones resistant to *Sphaerotheca mors-uvae* and four cultivated varieties. The progenies were artificially infected with a suspension of spores at the four or five-leaf stage and kept in the greenhouse for three weeks after infection; all plants attacked by the fungus were then removed and the survivors were reinfected twice during the course of the summer; the final survivors were planted out in the field. In late summer, a spontaneous attack occurred on some of these plants, indicating that resistance had decreased.
Amongst the progenies all variations between great susceptibility and resistance were found; all plants attacked were classified as susceptible and it was then found that the percentage of resistant plants in the different crosses ranged between 0 and 30%. Resistance is thought to be determined by a number of recessive and additive factors of differing strength so that heterozygote genotypes can confer resistance. Microscopic examination of young leaves of susceptible and resistant varieties infected in the greenhouse revealed that even under conditions favourable to the development of the fungus, some of the varieties were not attacked; in these plants the epidermal cells showed a hypersensitive reaction. Other varieties showing field resistance were slightly attacked under greenhouse conditions.

4415 Fagerlind, F.
**Hip and seed formation in newly formed *Rosa* polyploids.**
Act. Hort. Bergiani 1958 : **17** : 229–56.

Colchicine-induced polyploids derived from *R. rugosa* and intraspecific and interspecific hybrids of this species bore no hips, with the exception of the first-planted polyploids in two years. These tended however to show irregularities in the development of the hips, achenes and seeds. The impaired fertility is interpreted on the primary basis of physiological disturbance due to greater sensitivity to changes in the internal and external environments. The partial fertility of the oldest polyploids is attributed to physiological autoadjustment. A discussion is given of the possible role of such a process in newly synthesized polyploids of other plants.

4416 Łucka, M.
Porównanie plenności odmian truskawek. **(Comparison of the productivity of strawberry varieties).**
Zeszyt. nauk. wyższ. Szkoł. roln. Krakow. : Rolnictwo 1957 : No. 2 : 159–84.

Details of morphological and physiological characters, maturity period, quality, pollen fertility and yield are given for 10 varieties tested in Poland.

4417 Oleksiak, W., Pieniążek, S. A., Smolarz, S., & Wojtkiewicz, H.
Wartość produkcyjna 15 odmian truskawek w rejonie Skierniewic w pierwszym roku owocowania. **(The productive value of 15 strawberry varieties in the region of Skierniewice in the first year of fruiting).**
Prace Inst. Sadownict. Skierniewicach 1958 : **3** : 91–100.

In a trial laid out at Skierniewice, Poland, in 1958, Freja and Ydun gave the highest yields and also yielded the largest fruits, but were among the lowest in commercial quality. The less productive varieties generally developed more runners than the low-yielding varieties. June yellows occurred in Climax M46.

4418 Čaročkin, M. M.
**(The best strawberry varieties for the north).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : 55–56. [Russian].

The growth periods and yields of a number of varieties have been studied in the Komi ASSR and the following are recommended as most adapted to the local climatic conditions: Saksonka [Saxon], Aborigen Altajskij [Aboriginal Altaj], Krasavica Zagor'ja [Transmontane Beauty], Louise, Roščinskaja, Pavlovskaja Krasavica [Pavlovsk Beauty], Marshall, Komsomol and the wild-type strawberry Milanskaja [Milan]. Of these varieties Komsomol is self-sterile. Among the varieties with a yield of 40–50 c. per ha. was the early everbearing cultivar Sahalin.

4419 Goedegebure, L.
Rassenproef bij aardbeien. **(Varietal trial of strawberries).**
Fruitteelt 1959 : **49** : 21–22.

Results are given of tests of 12 varieties, carried out in 1957 and 1958 at Wilhelminadorp,

Netherlands. Several varieties attained yield increases of more than 100% in their second year compared with their first. Among 12 new selections, those from Zeeland did best on heavier soils while those from Brabant were better on light soils.

4420 Comstock, R. E., Kelleher, T., & Morrow, E. B.
**Genetic variation in an asexual species, the garden strawberry.**
Genetics 1958 : **43** : 634–46.

Wright's views on the genetic situation to be expected in a species in which reproduction is usually asexual but occasionally biparental are discussed. These views have been interpreted to imply that, in a population derived entirely from biparental matings between members of a species which is normally asexual, there would be a large amount of genetic variance of which a significant fraction would be epistatic.
The results of an experiment with strawberries conform to this interpretation. Random biparental crosses were effected among 40 selected clones and estimates were made of the genetic variance of five quantitative characters in the resulting population. These characters were: square size, a square comprising a seedling plant and the runner plants derived from it; the number and total weight of the berries per square; the average weight of a berry; and the average weight of berries per unit of square size. For each of these characters, the genetic coefficient of variation was found to be large. "Estimates of genetic variance among individuals within full sib families were too large to be rationalized in terms of associated estimates of additive genetic and dominance variance and were interpreted as due to presence of considerable amounts of epistatic variance."

4421 Staudt, G.
Eine spontan aufgetretene Grossmutation bei *Fragaria vesca* L. (**A tall mutation which arose spontaneously in *F. vesca* L.**).
Naturwissenschaften 1959 : **46** : 23–24.

The mutant described was discovered at the Max Planck Institute, Köln-Vogelsang, amongst plants descended from seed collected in Madeira. A single recessive gene is responsible for the mutant form which is designed *arborea*. The mutant has very long internodes; plants were found to reach 87 cm. in height after 19 months growth in a greenhouse. Growth of the stem is orthotropic. The pollen of the mutant is normal but female fertility is very variable. Plants heterozygous for the mutant gene show normal female and male fertility.

4422 Vinogradova, V. A.
(**The strawberry variety Birjulevskaja Rannjaja**).
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 2 : p. 57. [Russian].

The economic value of Birjulevskaja Rannjaja 206–19 [Birjulevo Early 206–19], which has been previously described [720], has been borne out by further trials under Moscow conditions.

4423 Ishihara, K.
(**The cultivation of strawberry varieties. With special emphasis on personally raised varieties**).
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1187–90, 1495–99. [Japanese].

A brief account is included of recent Japanese work on strawberry breeding and descriptions are given of some newly bred Japanese varieties.

4424 Thorsrud, J.
Utvalg af kloner i jordbærsorten Abundance. (**Selection of clones in the strawberry variety Abundance**).
Frukt og Bær 1958 : **11** : 42–45.

Clones of Abundance from different areas in Norway showed marked variation in yield, those with the highest yield being those with the greatest winter hardiness. It is supposed that the differences result from natural selection. Clone D52 was one of the best.

4425 Kronenberg, H. G,
**Poor fruit setting in strawberries. I. Causes of a poor fruit set in strawberries in general.**
Euphytica, Wageningen 1959 : **8** : 47–57.

External factors causing low fruit set include: night frost, to which Madame Moutot and Madame Lefeber are susceptible while Jucunda and *Fragaria virginiana* are resistant; damage of flowers by parasites; inclement weather during flowering; insufficient pollination under glass or in overcrowded beds; and soil type. On the basis of pollen quality, the octoploid cultivated varieties under study at Wageningen, Netherlands, fell into three groups: I, with usually a high percentage of good pollen; II, with a moderate but seldom low percentage; and III, with a low or very low percentage. Well-developed stamens were generally associated with good pollen and poor stamens with bad pollen. Fruit set was usually good in group I and II but was occasionally low in members of group II; group III contained only Jucunda and Madame Moutot, in both of which poor

setting occurs. However, no correlation between pollen fertility and self fertility was detected. Pistil fertility varied and tended to be greatest in the first flowers. Crosses between octoploid varieties were generally successful, only Jucunda giving low fruit sets when used as mother plant.

4426 FULTON, R. H.
**Spread of strawberry red stele root rot, *Phytophthora fragariae*, by resistant varieties and the survival period of the organism.**
Plant Dis. Reptr. 1959 : **43** : 270–71.
Strawberry varieties Fairland, Sparkle and Temple, all known to be resistant to *Ph. fragariae*, have been shown to be carriers of the pathogen and able to transmit it through the soil to susceptible varieties.

4427 JANICK, J. & WILLIAMS, E. B.
**Resistance of strawberry varieties and selections to leaf spot and scorch.**
Plant. Dis. Reptr. 1959 : **43** : 413–17.
Forty-one strawberry varieties were tested for incidence of *Mycosphaerella fragariae* and *Diplocarpon earliana* at Lafayette, Ind. Greatest resistance to the first was found in British Sovereign, Aroma, and Crimson Flash, to the second in Crimson Flash, Empire and the lines Md.US2210 and Wisconsin 214. In addition to the varieties mentioned, Catskill, Fairfax and Midland gave a low incidence of infection by both pathogens.

4428 VAN ADRICHEM, M. C. J. & ORCHARD, W. R.
***Verticillium* wilt resistance in the progenies of *Fragaria chiloensis* from Chile.**
Plant Dis. Reptr. 1958 : **42** : 1391–93.
Seedlings of *F. chiloensis* collected from eight locations in Chile were tested for resistance to *Verticillium albo-atrum*. In three instances resistant plants were found, and tolerant plants in four others. It is suggested that resistance in certain cultivated varieties may have been introduced from Chilean *F. chiloensis* and that by selfing, resistant lines may be isolated.

4429 VARNEY, E. H., MOORE, J. N. & SCOTT, D. H.
**Field resistance of various strawberry varieties and selections to *Verticillium*.**
Plant Dis. Reptr. 1959 : **43** : 567–69.
Of 50 varieties tested in a heavily contaminated field in New Jersey, the wild species *F. virginiana* 'Sheldon clone', and Vermilion (Redstar x Pathfinder) were found to be completely resistant to *Verticillium* wilt. Catskill, Md-US1972, NC1759, and Md-US2650 were also highly resistant. Indications were found of the existence of strains of *Verticillium* of differing pathogenicity, accounting for the collapse of a number of plants of supposedly resistant varieties such as Blakemore and IVT667–Juspa.

4430 SHEPHERD, K.
**Two new basic chromosome numbers in the Musaceae.**
Nature, Lond. 1959 : **183** : p. 1539.
IR503, a collection from British North Borneo studied at the Imperial College of Tropical Agriculture, Trinidad, shows some resemblance to species belonging to sect. *Callimusa* ($2n = 20$) but differs in its seed characters and chromosome number ($2n = 18$). IR510, a collection from the highlands of north-central New Guinea, has $2n = 14$ and is reminiscent of *Ensete* in its largish seeds but in some other respects resembles *Musa*. In its sparse suckering it is intermediate between the two genera. The taxonomic position of these introductions has not yet been determined. Only IR503 has so far flowered in Trinidad. Chains of three or four chromosomes were occasionally seen at metaphase I, indicating heterozygosity for a small translocation. Although translocations are known to occur frequently in edible bananas and experimental hybrids of *Musa*, the present case is the first in which heterozygosity for a translocation has been recorded in a wild collection.

4431 TOMLINSON, P. B.
**An anatomical approach to the classification of the Musaceae.**
J. Linn. Soc. 1959 : **55** : 779–809.
Concerning *Musa*, evidence was obtained that the genus is quite distinct anatomically from other genera in the Musaceae, although it shows some affinities with the *Ravenala-Strelitzia* complex.

4432 STOVER, R. H.
**Studies on *Fusarium* wilt of bananas. IV. Clonal differentiation among wild type isolates of *F. oxysporum* f. *cubense*.**
Canad. J. Bot. 1959 : **37** : 245–55.
As a result of a study of isolates from Honduras and elsewhere, the occurrence of biotypes of *F. oxysporum* f. *cubense* differing in pathogenicity is reported.

4433 **New varieties.**
Amer. Fruit Gr. 1959 : **79** : No. 5. : p. 41.
The new grape varieties Exotic and Magoon

have been released by the US Department of Agriculture. Maturing a week earlier than Cardinal, Exotic bears nearly black berries with good dessert quality and transportability. Magoon is an early midseason muscadine type, well adapted to the central and southern parts of the Gulf Coast states and Georgia. The fruit is a dull reddish purple, thick skinned and fine flavoured.

4434 Cosmo, I., & Polsinelli, M.
"Sylvaner verde". (**Green Sylvaner**).
Ann. Sper. agr. 1959 : **13** : No. 1 : Suppl. : lxxx–lxxix.

The vine described, thought to have been introduced into northern Italy from Austria or the Rhine valley, produces a white wine of fairly high quality.

4435 Cosmo, I., & Polsinelli, M.
**"Negretto".**
Ann. Sper. agr. 1959 : **13** : No. 1 : Suppl. : lxxxi–lxxxviii.

The vine described is grown in the Bologna region of Italy for use both fresh and in the preparation of a common type of red wine.

4436 Cosmo, I. & Polsinelli, M.
**"Sémillon".**
Ann. Sper. agr. 1959 : **13** : No. 1 : Suppl. : lxxxix–xcv.

This French vine, which is described, is used in northern Italy in small quantities for the production of a good aromatic white wine.

4437 Cosmo, I., Benedetti, A., & Forti, R.
**"Terrano".**
Ann. Sper. agr. 1959 : **13** : No. 1 : Suppl. : xcvii–cvii.

This vine, thought to have been introduced into northern Italy from Istria, is used for making a red wine, which in certain areas is aromatic and good in quality.

4438 Mazzei, A., & Zappalà, A.
**"Nocera".**
Ann. Sper. agr. 1959 : **13** : No. 1 : Suppl. : cix–cxvi.

The origin of this vine, grown in the Messina province of Sicily, is uncertain; it is used to prepare a strong red wine of the Bordeaux type, of good quality and aroma.

4439 Cosmo, I. & Polsinelli, M.
"Pinots". (**The Pinot grapes**).
Ann. Sper. agr. 1959 : **13** : No. 2 : Suppl. : xxix–xlviii.

The white, grey and black forms of Pinot, all of which are grown to a certain extent in northern Italy for wine, are described.

4440 Cosmo, I., Forti, R. & Sardi, F.
**"Cabernet Sauvignon".**
Ann. Sper. agr. 1959 : **13** : No. 2 : Suppl. : lxxv–lxxxiv.

The vine described is grown in northern Italy, though to a lesser extent than Cabernet franc, to which it is considered inferior.

4441 Violante, C. & Bordignon, S.
"Asprinio bianco". (**White Asprinio**).
Ann. Sper. agr. 1959 : **13** : No. 2 : Suppl. : lxxxv–xciv.

The vine described, the origin of which is doubtful, produces a light sparkling white wine in the Naples region of Italy.

4442 Violante, C. & Bordignon, S.
**"Piedirosso".**
Ann. Sper. agr. 1959 : **13** : No. 2 : Suppl. : xcv–cvi.

The vine Piedirosso [Red-foot], of the Naples area in southern Italy, is considered to be of very ancient origin and produces an aromatic wine of the *rosé* type.

4443 Konstantinesku [Constantinescu], G. & Negrjanu [Negreanu], E.
(**Promising new hybrids for viticulture in the Rumanian People's Republic**).
Rev. Biol., București 1957 : 305–18. [Russian].

[Cf. XXVIII, 2234].

4444 **Dix, new juice grape.**
Agric. Res., Wash. 1959 : **7** : No. 10 : p. 15.

Dix has black medium-sized berries with a mild to neutral flavour; they ripen about the same time as Concord. Both juice and pulp are intense red; the former is suitable for blending with less colourful juice. Soluble-solid content of the juice ranges from 14 to 17% and acidity from 0·5 to 0·8%. Dix originated as a seedling from a cross between America and Bailey. The plants are vigorous, moderately productive and as resistant to foliage diseases as Fredonia. Fruit bunches are medium to small, uniform in shape, and usually without a shoulder.

4445 Žurin, A. B. & Semenova, Z. S.
(**The All-Union Inspection of vines at the USSR Agricultural Exhibition**).
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 2 : 60–61. [Russian].

Mention is made of new varieties bred in the various Soviet Republics, including hybrids from Central Asia with large seedless berries and dessert vines of quality superior to the

present standard varieties. Worth mention is the new Ukrainian dessert variety Krasavica Ukrainy [Beauty of the Ukraine] (Elizaveta x Žemčug Krasnyj [Red Pearl]), which produces attractive bunches of medium size, with pink oval berries having a pleasant muscat flavour. It transports well.

4446 Rives, M. & Pouget, R.
Le Chasselas Gros Coulard—mutant tétraploïde. (**Chasselas Gros Coulard, a tetraploid mutant**).
Vitis 1959 : **2** : 1–7.

A description of this mutant is given; cytological investigations showed that it is a homogeneous tetraploid and not a chimera. Its pollen is less fertile than that of the normal form. On account of their large size, the berries are particularly suitable for table use. These tetraploids are being propagated from seed with a view to finding forms with improved fertility amongst the progenies.

4447 Enin, T. K.
(**Polyploid vines**).
Sadovodstvo, Vinogradarstvo i Vinodelie Moldav. (Hort. viticult. wine-mak. Moldav.) 1956 : No. 6 : 32–34. [From Ref. Ž. (Ref. J.) 1958 : No. 6 : Abst. 23822 : p. 34]. [Russian].

Young shoots of unspecified vines were decapitated and treated with a 0·05% aqueous solution of heteroauxin at the cut surface. This stimulated growth of polyploid shoots from the callus. The cells composing the new tissues were abnormally large and had two or three nuclei.

4448 Kuz'min, A. Ja.
(**Breeding and the growth phases of vines**).
Agrobiologija (Agrobiology) 1958 : No. 5 : 60–66. [Russian].

Breeding vines for winter hardiness and short growth period at Mičurinsk is discussed. The periods required by a variety from (1) opening of the buds to the beginning of flowering, (2) initiation of flowering to the beginning of maturation and (3) incomplete to full ripeness of the grapes were ascertained and varieties differing in respect of these phases were crossed. Several hybrids of Russkij Konkord [Russian Concord] x Early Malingre, Russkij Konkord x Halili Černyj [Black Halili] and Russkij Konkord x White Chasselas have been selected and are under observation. Worth mention are élite 17 from the first and élite 44 from the last mentioned cross; these ripen 6 and 12 days respectively before the earlier parent.

4449 Lavee, S.
**Physiological aspects of post harvest berry drop in certain grape varieties.**
Vitis 1959 : **2** : 34–39.

Storage experiments were carried out with two grape varieties. Hamburg Muscat showed a "dry drop" due to the formation of an abscission layer. Dabouki had no "dry drop", berries being lost mainly by mechanical injury. Dry drop could be prevented by placing the fruit in a cold store immediately after picking; when cold storage was delayed, spraying with growth regulators before picking reduced the shedding.

4450 Huglin, P.
Recherches sur les bourgeons de la vigne: initiation florale et développement végétatif. (**Investigations on vine buds: floral initiation and vegetative development**).
Ann. Inst. nat. Rech. agron., Paris : Sér. B. : 1958 : **8** : 113–272.

The studies reported were carried out at Colmar in Alsace with a large collection of different grape varieties. Differences were noted between scion varieties in respect of the "fertility" of primary latent buds, all the vines being grown under similar conditions. Fertility means in this context the number of normal inflorescences produced by the buds. Of the principal varieties cultivated in Alsace, Riesling and Sylvaner were the most fertile; these varieties were also more regular in their floral production than others such as Chasselas and Pinot gris [Grey Pinot]. Most of the hybrids were more fertile than varieties of *Vitis vinifera*. Rootstocks were also found to have specific effects on the "fertility" of the buds of the scions.

4451 Gazzari, A. & Rumora, L.
Prilog poznavanju vrijednosti dalmatinskih sorata vinove loze. (**A contribution to the study of the value of Dalmation vine varieties**).
Biljne Proizvod. (Pl. Prod.) 1956 : **9** : 135–46.

Data are provided on the sugar content and acidity of 33 varieties tested during 1946–51.

4452 Dobrovada, K.
Škody spôsobené mrazom na sortách viniča roku 1956. (**The damage caused by frost to vine varieties in the year 1956**).
Pol'nohospodárstvo 1959 : **6** : 183–92.

Investigations were carried out on several varieties grown at different places in Czechoslovakia and information is provided on the

damage experienced by the buds and cambium of wood uncovered by snow or earth. Varietal differences in regeneration capacity were noted; Veltlínske zelené [Veltlin Green] and Veltlínske červeno-biele [Veltlin Red-White] were particularly good in this respect.

4453 Sakamoto, J. & Oki, J.
**(A comparison of vine varieties in respect of tolerance of excessive moisture).**
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1683–84. [Japanese].

On the basis of pot experiments, data are provided on the relative resistance of four introduced American scion varieties on one or other of two stocks to waterlogging.

4454 **(An All-Union conference on *Phylloxera* and mildew resistance of vines).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 153–54. [Russian].

This report discussing prophylactic measures and improved breeding techniques refers briefly to recent interspecific and intervarietal hybrids which combine *Phylloxera* resistance with a fair quality of grapes.

## FOREST TREES

4455 Wright, J. W.
**A bibliography on forest genetics and forest tree improvement, 1955.**
Sta. Pap. Northeast. For. Exp. Sta. 1957 : No. 90 : Pp. 60.

A bibliography of 717 titles is presented, together with a subject index.

4456 Holzer, K.
Forstpflanzenzüchtung und "Naturnahe Waldwirtschaft". **(Forest tree breeding and "close-to-nature forest management").**
Allg. Forstztg. 1959 : **70** : 51–52.

In this brief article, mention is made of some of the general principles and problems of breeding forest trees.

4457 Metsäpuiden rodunjalostussä ätiö Toiminta 1958. **(Foundation for Forest-tree Breeding Activities in 1958).**
Pp. 31.

The Vanaja Tree Breeding Station has been the centre of activities. Twenty-four plus stands, more than half of them of *Pinus sylvestris*, have been added to those already selected, and over 400 plus trees, also chiefly Scots pine. A large number of the best stocks have been marked for seed collection, and seed has been collected from curly birch, elm and black alder. The seedling nursery has been expanded and contains several coniferous and other stocks. Grafting experiments have included successful grafting of triploid curly birch on to diploid stock.

4458 Khan, A. W.
**Recent work in forest genetics : post-fellowship report.**
Pakist. J. For. 1959 : **9** : 124–31.

A short survey of progress achieved in forest-tree breeding in various countries and of the techniques employed is followed by an indication of the scope existing for the application of genetical principles in breeding forest trees in Pakistan and by suggestions as to ways in which the improvement of *Tectona grandis, Gmelina arborea, Lagerstroemia flos-reginae* and bamboos could be tackled.

**Proceedings of the Fourth Southern Conference on Forest Tree Improvement held at Athens, Georgia, January 8 and 9, 1957** : Pp. 149. (Mimeographed).

4459 *Jackson, L. W. R. & Greene, J. T. Hereditary variations in slash pine tracheids.* (*pp. 23–26*).

[Cf. 3151].

4460 *Zobel, B. Inheritance of wood properties in pine.* (*pp. 27–29*).

In studies of *Pinus taeda* conducted in Texas, no high correlations were detected between tracheid lengths in the first growth ring and in the mature wood; some correlation in length was found between fifth-year and mature-wood tracheids and a very high correlation occurred between tenth-year and mature-wood tracheids, indicating that selection may be effected in ten-year old trees. There was no correlation between the growth rates of trees and their tracheid lengths. A high correlation between the specific gravities of limb wood and bole wood occurred in trees up to 12 years in age. The progeny of an open-pollinated mother tree with high specific gravity had a higher specific gravity than that from a mother tree with a low value and similar results were obtained with the progenies from three selfed trees differing in specific gravity. Little difference in specific gravity was found between four-year old scions originating from trees with extreme values, and it is suggested that the root may have an important effect upon the scion.

4461 *Cech, F. C. & Goddard, R. E. Selecting drouth resistant loblolly pine in Texas.* (*pp. 30–33*).

Seed from the phenotypically best trees in stands in nine areas in Texas and other states, six of the localities being dry and three having high rainfall, were grown in six dry areas in Texas and one in Louisiana. Trees from the Fayette County and Bastrop County sources in Texas, both of them areas with low rainfall, showed the greatest survival after drought during the first few years and also had a satisfactory growth rate.

4462 *Gilmore, A. R. Physical and chemical characteristics of loblolly pine seedlings associated with drought resistance.* (*pp. 34–39*).

On the basis both of greenhouse tests and of previous progeny tests of the mother trees, seedlings of *Pinus taeda* were divided into two groups: (1) drought resistant and (2) less drought resistant. Group 1 transpired less per g. of needle dry matter than group 2, particularly under conditions of low soil moisture, and were able to extract more water from the soil. Analysis of stems, needles and roots revealed that, compared with group 2, group 1 had more reducing sugars in the stems and needles, more total carbohydrates in the roots, less thiamin in the stems and needles and less nitrogen, potassium, calcium and phosphorus in all plant parts, with the exception of a higher content of calcium in the roots.

4463 *Zak, B. Resistance to littleleaf in shortleaf pine.* (*pp. 41–43*).

[Cf. XXVI, 3837].

4464 *Barber, J. C. & Dorman, K. W. Slash pine progeny tests indicate genetic variation in resistance to rust.* (*pp. 44–46*).

Progenies from rust-free mother trees selected from a severely infected stand at Chipley, Ga., showed less infection than control seedlings. The best progeny, from the tree C–37, had less than half the amount of canker shown by the controls and was among those with the highest growth rate.

4465 *Greene, J. T., Dorman, K. W. & Bauer, E. Differential growth rate of young progeny of individual slash pine trees.* (*pp. 47–50*).

In studies of the five-year old open-pollinated progenies of six pines selected for vigorous growth at Chipley, Ga., the four mother trees C–10, C–37, C–50 and C–63 produced seedlings which grew rapidly and two, C–6 and C–51, gave offspring with slower growth.

4466 *Jewell, F. F. Inoculation techniques in studies of rust resistance.* (*pp. 67–69*).

Inoculation of 30-day old seedlings of *Pinus elliottii* at high humidities under canvas tents, using small oak branches with telial infections as inoculum, produced red spots on the cotyledons at six weeks in many plants. At eight months, a similar proportion of seedlings showed the characteristic stem swellings caused by *Cronartium fusiforme*, suggesting that the red spots form an early symptom of infection which may be useful in selection. Year-old plants could be inoculated by wrapping the new growth with infected oak leaves and keeping moist, but this method produced no spots on the needles.

4467 *Hoekstra, P. E. Stimulation of flower and seed production in slash pine.* (*pp. 74–75*).

Root pruning, partial girdling and application of fertilizers proved to be effective treatments in inducing 6-year old saplings to flower prematurely and in increasing flower production in 20-year old cone-bearing trees.

4468 *Wang, C.-W., & Perry, T. O. Grafted seed orchards in the south.* (*pp. 93–101*).

The establishment of seed orchards of *Pinus elliottii* and *P. taeda* in Florida, Georgia, South Carolina and Alabama is described.

4469 *Joranson, P. N., May, M. N. & McKee, R. C. Forest genetics at the Institute of Paper Chemistry.* (*pp. 105–07*).

The chief objectives in breeding hardwoods and softwood to improve their suitability for the paper-board industry are discussed.

4470 *Snyder, E. B. Pollen handling.* (*pp. 111–15*).

Pollen shedding in slash pine may be hastened by placing cut branches bearing male inflorescences in jars of water in the greenhouse. Storage is best at a moisture content of 14% and an apparatus for extracting and drying pollen simultaneously is described.

4471 *Ellertsen, B. W. Progress in nursery selection of loblolly, shortleaf and white pine super-seedlings.* (*pp. 132–35*).

Of the exceptionally tall seedlings selected and planted out at Clinton, Tenn., in 1951–55, 86% have survived, of which five in eight have continued to outgrow the controls.

4472 *Wyckoff, S. N. New developments in forest genetics research programs around the country.* (*pp. 142–47*).

A brief survey of the main projects in progress in the USA is presented.

4473 Perry, T. O. & Wang, C.-W.
**Cooperative Forest Genetics Research Program. Second Progress Report, 1955–1957.**
Univ. Fla. Sch. For. Res. Rep. 1957 : No. 4. Pp. 28.

**Maple**. *Acer rubrum* collected from an area ranging from northern Canada to southern Florida showed clinal variation in winter chilling requirement which was related to the number of frost-free days. The winter-chilling requirement appears to be controlled by several genes.
***Liquidambar***. Progeny tests of *L. styraciflua* show that there is distinct genetic variation in leaf colour after autumn frost.
**Pine.** Numerous crosses have been effected between parents of different provenance. Pollen and flowering scions are collected by means of a high-powered ·22 rifle. Loblolly pines from different latitudes showed different photoperiodic responses in seasonal growth, a distinct clinal pattern in relation to the frost-free season and latitude of origin being found.
Aberrant seedlings originally believed to be hybrids of *Pinus palustris* and *P. taeda* appeared at a later stage to be intermediate between *P. elliottii* var. *elliottii* and *P. palustris* and resembled artificial hybrids of these parents. South Florida slash pines (*P. elliottii* var. *densa*) show many of the same characteristics as the hybrids and are believed to have originated through introgressive hybridization between *P. elliottii* and *P. palustris*.

4474 Inman, L. L.
**The divergent points of view of forest geneticists and of agronomic and horticultural crop breeders.**
J. For. 1959 : **57** : 375–77.

The author believes that the problems of hereditary improvement in forest trees are not essentially different or more complex than those encountered in the breeding of other crops and advocates that the basic principles of plant breeding and genetics discovered in work with nonforest species should be applied in forest-tree breeding. At present forest-tree geneticists are still working on problems that were solved for other crops years ago. In spite of the limited information available on the genetics of forest species, it is thought that an efficient breeding programme can be developed. Much forestry work is based on the assumption that it is possible to recognize by appearance alone those trees which will make good parents for improving growth form and rate. It is pointed out that this assumption is contrary to breeding experience with both forest and nonforest species.

4475 Stern, K.
Der Inzuchtgrad in Nachkommenschaften von Samenplantagen. (**The amount of inbreeding in progenies of seed plantations**).
Silv. genet. 1959 : **8** : 37–42.

Methods of determining the rate of inbreeding in seed plantations consisting of $N$ clones are shown. It is thought that the number of clones required in a seed plantation in order to prevent inbreeding effects is 20 to 30 in the case of ideal panmixis, 30 to 40 when panmixis is greatly reduced and 40 to 50 when there is continuous selection of $N$ clones through several generations.

4476 Rohmeder, E. & Eisenhut, G.
Untersuchungen über das Mikroklima in Bestäubungsschutzbeuteln. (**Investigations on the microclimate in isolation bags**).
Silv. genet. 1959 : **8** : 1–12.

The results are reported of investigations on the microclimate inside polyethylene, cloth and pergamine bags used in forestry; the merits of the three types of bag are compared. The cloth bags had the following advantages: (1) they are less susceptible to injury than the other types; (2) an exchange of gases with the outside atmosphere takes place through the pores of the material and (3) fluctuations in temperature within the bags are small. The other types of bag are less expensive but the climatic conditions inside are unfavourable. Cloth bags can be fitted with a polyethylene window so that the development of the flowers inside may be observed. In general, cloth with pores of 20 $\mu$ and 10 $\mu$ diameter is suitable for coniferous and broad-leaved trees respectively.
These bags provided no protection against frost but it was found that by using small electric heaters the appearance of frost in the bags could be prevented even with an outside temperature of — 8° C.

4477 Zobel, B. J.
**Forest genetics and the pulp industry.**
TAPPI, Pa. 1957 : **40** : No. 3 : 42A, 44A, 46A.

It is noted that work on the inheritance of high specific gravity of the wood in various species and tracheid length in loblolly pine is in progress in Texas.

4478 Vaartaja, O.
**Evidence of photoperiodic ecotypes in trees.**
Ecol. Monogr. 1959 : **29** : 91–111.

Greenhouse tests were carried out to determine

the reactions of 38 economic tree species belonging to 19 genera and represented by 81 seed sources from varying latitudes in the northern hemisphere, when the seedlings were subjected to day lengths of 12, 14, 16 and 18 hr. In general, the farther north the origin of the seed, the more sensitive was the response to the treatments and the longer the maximum or critical day length strongly inhibiting growth. It is suggested that photoperiodic ecotypes have evolved as an indirect means of adaptation to various seasonal climatic factors. The occurrence of photoperiodic ecotypes is discussed in relation to the general problem of the interpretation of the results of provenance trials.

4479 KRAHL-URBAN, J.
Eichen- und Buchenrassenstudien in Österreich. (**Studies of races of beech and oak in Austria**).
Zbl. ges. Forstw. 1958 : **75** : 34–60.

On the basis of earlier provenance studies in Austria and Switzerland and of the present studies of beech and oak stands in Austria, it is concluded that distinct local races of beech and sessile and pedunculate oaks occur. Tree form, spiral growth, regeneration, bark characteristics and other traits were studied and the climatic factors possibly exerting a selective effect upon them are discussed.

4480 FERENC, K.
Újabb eredmények a nyár és a fűz nemesítése terén. (**Recent results in the breeding of poplar and willow**).
Magyar tud. Akad. Agrártud. Oszt. Közl. 1959 : **15** : 237–41.

Work on poplars and willows at Sárvár, Hungary, includes (*a*) the introduction of foreign species and varieties, (*b*) the selection of native species and varieties and (*c*) hybridization. A combination of rapid growth, good tree form, resistance to diseases and tolerance of drought occurs in hybrids from *Populus tremula* x *P. tremuloides*, *P. tremula* x *P. tremula*, *P. canescens* x *P. grandidentata*, *P. canescens* x *P. alba* var. *bolleana*, *P. alba* x *P. grandidentata* and *P. alba* x *P. alba* var. *bolleana*.

4481 WETTSTEIN, W. & VIEGHOFER, L.
Physiologische Unterschiede morphologisch nicht unterscheidbarer Pappelklone. Prüfungsergebnisse der sog. Drapal-Pappel. (**Physiological differences between morphologically indistinguishable poplar clones. Results of experiments with the so-called Drapal poplar**).
Holzforschung 1958 : **11** : 139–42.

Eleven clones of the Drapal poplar, whose putative origin is *Populus marilandica* x *P. nigra*, fell into the following three groups when grown at Tulln, Lower Austria: (1) four clones with rapid growth rate, good regenerative ability and tolerance of autumn frosts through early cessation of annual growth; (2) three clones morphologically similar to the first but poor in growth rate; and (3) four clones morphologically distinct from the others, all with rapid growth rates but two with timber defects.

4482 SCHÖNBACH, H.
Die bisherigen Ergebnisse der Züchtungsarbeiten mit verschiedenen Pappelarten der Sektion *Leuce*. (**Results obtained up to now in breeding work with different poplar species of the section *Leuce***).
Wiss. Abh. dtsch. Akad. LandwWiss., Berlin 1957 : No. 27 : 149–78; Beitr. Pappelforsch. No. 2.

Comparisons of plant height in first-year progenies grown in different areas showed that the coefficient of variation is greater for populations with low mean height than for those with high, in comparisons both of the same population under different conditions and of different populations under the same conditions. In intraspecific and interspecific crosses involving *Populus tremula*, those in which the latter partner was of north or north-east European origin consistently gave $F_1$ progenies which ceased vegetative growth early in the season, irrespective of whether the second parent was of German or southern origin. Most of the plants in the progenies of the long-day northern parents showed correspondingly less growth in height, but a few were similar in height to the plants of short-day progenies and may be useful for further selection. Under conditions of severe rust infection, all progenies with the aspen Graupa 18 as pollen parent showed a high incidence of the disease while others remained almost free from infection. Certain parents also transmitted high susceptibility to *Fusicladium radiosum*, but no progenies resistant to this pathogen were observed.

Branching in the first year was very marked in the $F_1$ of crosses of *P. alba* and *P. tremula*, rather less so in crosses of *P. canescens* and *P. tremula* and almost absent in intraspecific *P. tremula* crosses. Differences in wind resistance were detected among progenies, the interspecific crosses tending to give a higher proportion of resistant individuals than pure aspen crosses. Parallel trials in different areas showed that the relative proportions of branch and trunk wood varied according to locality.

In *P. tremula* x *P. tremula* populations, the proportion of *pendula* forms depended on both genetic constitution and locality. The good characteristics of several parents were apparent in their progenies in all the best areas.

4483 Brückmann, J. J.
Ecotipos de álamos y zonas fototérmicas concordantes en la República Argentina. (**Poplar ecotypes and corresponding photothermal zones in Argentina**).
Rev. for. argent. 1957 : **1** : No. 2 : 53–59.

Clones of various species and hybrids tested in the Paraná Delta fell into three groups on the basis of time of flushing and duration of vegetative period. These three groups appeared to correspond with climatic areas distinguished by differences in photoperiod, rainfall and duration of the dry season.

4484 Polster, H.
Transpirationsintensität und Wasserbedarf von Pappelklonen. (**Transpiration rate and water requirements of poplar clones**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1957 : No. 27 : 99–147; Beitr. Pappelforsch. No. 2.

In tests of 58 clones of poplar species and hybrids it was found that differences in transpiration rate may be greater between clones of one poplar type than between different types, although some similarities between related clones were observed. Clones of *P. trichocarpa* and the clone Oxford 313 were in the group with the lowest transpiration rate, while *P. serotina* '272', *P. gelrica* '308', *P. bachelieri* '101' and *P. regenerata* '275' were among those with the highest. The mean transpiration was greater than for other broad-leaved species.

4485 Röhrig, E.
Untersuchungen über das Jugendwachstum von Schwarzpappelhybriden auf verschiedenen Standorten. (**Investigations on the early growth of black poplar hybrids in different localities**).
Silv. genet. 1959 : **8** : 24–30.

Six black poplar hybrids of importance in Germany were grown together in 31 different localities. In all places *Populus robusta* and *P. vernirubens* showed the best annual increase in height. *P. regenerata* and Leipzig showed 87·0 and 88·5% respectively of the height increase of *P. robusta*, these values being means for all the experimental plots; the corresponding values for *P. serotina* and *P. marilandica* were 79·7 and 77·4% respectively. The results indicated that the hybrids had similar soil requirements during their young stages. It is stated that *P. regenerata* suffered less from attack by *Dothichiza populea* than *P. robusta* and Leipzig. Also *P. regenerata* was only slightly attacked by *Melamspora* spp.

4486 Schönbach, H.
Untersuchungen über Cellulosegehalt und Raumgewicht von Pappelhölzern im Rahmen der Züchtung. (**Investigations on cellulose content and volume weight with reference to breeding**).
Wiss. Abh. dtsch. Akad. LandwWiss. Berlin 1956 : No. 16 : 9–39; Beitr. Pappelforsch. No. 1.

Cellulose content in poplar clones studied in Graupa, Germany, varied both within trees and within and between clones, there being a general tendency for the content to increase from the second to the fourth year. *Populus berolinensis*, *P. robusta* and *P. trichocarpa* each included a number of clones which were above the average in cellulose content throughout the first four years, *P. berolinensis* having the highest proportion of such clones. *P. euramericana* had no clones consistently high in content. It is thought that some of the better clones may be of use in breeding cellulose-rich types for the artificial-fibre industry.

4487 Bezkorovajnyj, M. F.
(**Hybrid poplars in the Leningrad province**).
Les. Hoz. (Forestry) 1958 : No. 3 : p. 82. [Russian].

Ten interspecific hybrids originating from Kamyšino, Stalingrad province, have been vegetatively reproduced in the province of Leningrad. All showed good growth and development and overwintered well in the severe winter of 1955–56.

4488 Bogdanov, P. L.
(**New hybrid poplars**).
Les. Hoz. (Forestry) 1958 : No. 3 : 85–86. [Russian].

New forms of poplars obtained by vegetative or sexual hybridization at Leningrad include two forms distinguished by quick growth and a high degree of resistance to cold. Clone 13/8 was selected from *Populus deltoides* x *P. suaveolens*. The other form arose from a bud at the callus of the vegetative hybrid *P. suaveolens*/*P. deltoides*. It is unusual in that it gives segregates

resembling the stock or scion parent or having mixed inheritance in its vegetative progeny.

4489 **Big afforestation programme in USSR. New variety of tree will flourish in deserts.**
Soviet News 1959 : No. 4051 : p. 100.
Drought-resistant poplars have been bred in a programme involving artificial pollination and vegetative hybridization of a poplar of section *Turanga* growing in the Amu Dar'ja valley. A fast-growing variety named Mir [Peace] is one of the results of this work.

4490 Schönhar, S.
Ein Beitrag zur Frage der Anfälligkeit verschiedener Pappelarten und Pappelsorten gegen *Dothichiza populea*. (**A contribution to the question of the susceptibility of various poplars to *D. populea*).**
Mitt. Ver. forstl. Standortskunde Forstpfl-Zücht. 1957 : No. 6 : 59–62.
Inoculation tests on various poplar species and hybrids at Stuttgart, Germany, have indicated that *Populus euramericana* f. *regenerata* has low susceptibility, *P. euramericana* f. *bachelieri*, *P. generosa* x *P. nigra*, *P. alba* x *P. grandidentata*, *P. tremula*, *P. trichocarpa*, Rochester (*P. maximowiczii* x *P. nigra* var. *plantierensis*) and Oxford (*P. maximowiczii* x *P. berolinensis*) moderate susceptibility and *P. nigra* var. *italica*, *P. simonii*, *P. alba* and *P. alba* x *P. tremula* high susceptibility. There is evidence that the reaction to infection of different types of poplar is differentially affected by water availability.

4491 Mišić, V.
Varijabilitet i ekologija bukve u Jugoslaviji. (**The variability and ecology of the beech in Yugoslavia**).
Biol. Inst. Srb. Posebna izdanja 1957 : **1** : 1–74.
The results of a study of the variation of different organs in a single tree of *Fagus moesica* revealed that the majority of organs are variable and react to small changes in the environment. The leaf is the most variable organ, particularly blade length, width of its base and length of petiole. The most variable characters of the flower are the length of the perianth and of the filament. The cupule shows only slight variation. The beech thus displays individual polymorphism.
Some differences in morphological characters may be the result of phenotypic changes in given environmental conditions. External factors are important in the formation of definite morphological characters, but their role and effect depend primarily on the hereditary basis itself. Through the segregation of particular variants and their migration to ecologically different habitats, the formation of ecotypes occurs. Three altitudinal beech ecotypes can be distinguished as follows: (1) the hilly type on lower slopes, (2) the midmontane type at intermediate altitudes and (3) the subalpine type at high altitudes. The pronounced differences in morphological characters between the ecotypes are hereditary with definite adaptive norms of response. They have been named respectively after characters of the cupule: (1) *brevipedunculata*, (2) *macrocarpa* and (3) *longipedunculata*. Crossing between *F. sylvatica*, *F. orientalis* and *F. moesica* does not usually occur naturally and these three geographical forms may be considered as good species.

4492 Natho, G.
Variationsbreite und Bastardbildung bei mitteleuropäischen Birkensippen. (**The range of variation and hybrid formation in central European birch races**).
Feddes Repert. 1959 : **61** : 211–73.
Detailed morphological studies revealed that the range of variation of *Betula pendula*, *B. pubescens* and *B. humilis* is rather small in Central Europe. Introgression between species is thought to be responsible for the variability reported by other investigators; introgression was found in most of the characters studied. The hybrids between any two species formed a swarm, showing continuous variation between parental characters; the rarity of intermediate forms indicated that back crosses were more successful than crosses between parental types. Some trispecific hybrids were also noticed.
It is suggested that all hybrids between the two tree species be designated *B. pendula* x *pubescens*. Hybrids of *B. pendula* x *B. humilis* should be named B. x *zabelii* and hybrids of *B. humilis* x *B. pubescens*, *B.* x *warnstorfii*. *B.* x *grossii* is the name suggested for the trispecific hybrid *B. humilis* x *B. pendula* x *B. pubescens*. Further subdivision of the hybrids is not recommended because of the existence of hybrid swarms.
Other investigations indicated that *B. carpatica* and *B. oycoviensis* should be retained as independent species: both are thought to have arisen from *B. pubescens* and *B. pendula* by introgressive hybridization. Chromosome counts were made for the different species and dispecific hybrids; the results agreed with those already obtained by other investigators.

4493 Eifler, I.
**Beschreibung einer Fixiermethode, die das Auszählen von Birkenschromosomen erleichtert. (Description of a fixing method which facilitates the counting of birch chromosomes).**
Züchter 1959 : **29** : 57–59.

In the procedure described, fixing of the material is best carried out on a relatively warm and sunny day, otherwise additional light and heat have to be provided. *Betula* roots are fixed in a mixture of alcohol and acetic acid (2 : 1 or 3 : 1) for 10–20 min. and then transferred to a 0·002 M oxyquinoline solution saturated with esculin; treatment with this solution lasts for 2 hr. at 2–4° C. and 22 hr. at room temperature. Squash preparations are then made using lacmoid as a stain. After this treatment, the chromosomes are well separated and easy to count. In making leaf preparations, esculin is not added to the oxyquinoline solution.

4494 Jackson, W. D.
**Natural hybrids in eucalypts.**
Pap. roy. Soc. Tasm. 1958 : **92** : 141–46.

Seedlings from open-pollinated mother trees of the supposed natural hybrid *Eucalyptus taeniola* were compared with seedlings from the putative parental types, *E. sieberiana* and *E. salicifolia*. The range of variation in size and form of the juvenile leaves in *E. taeniola* was intermediate between the ranges of the parents, although weighted towards *E. salicifolia*, confirming that it is a hybrid between the suggested parents.

4495 Suda, Y.
**The number of chromosomes in some Japanese salicaceous plants II.**
Sci. Rep. Tôhoku Univ. : Ser. IV 1959 : **25** : 13–19.

The chromosome number in *S. subopposita*, *S. lackschewitziana* var. *roridaeformis*, *S.* x *koiei* and *S.* x *ikenoana* is $n = 19$, while in *S. ohsidare* and *S. pseudokoreensis* var. *pendula*, $n = 38$.
Observations made on the premetaphase and metaphase plates in meiosis of the pollen-mother cells of *Chosenia bracteosa* revealed bivalents with appendages, but during further meiotic stages no bivalent separated into two different-sized univalents. Therefore the existence of heterochromosomes in this plant is doubtful.
Many secondarily associated bivalents at premetaphase and metaphase in the pollen mother cells of *C. bracteosa* were observed; 46·7% were single and 53·5% were associated in groups of two, three or four bivalents. No pollen mother cells without associated bivalents were found. Pollen mother cells with three and four groups of associated bivalents were observed most frequently, the maximum number seen being eight. Secondary association occurs between different-sized bivalents as well as between similar-sized ones. It is not known whether it occurs in other species of *Salix* but systematically it seems significant that the phenomenon occurs commonly in primitive genera of the Salicaceae such as *Populus*, *Toisusu* and *Chosenia*.

4496 Raup, H. M.
**The willows of boreal western America.**
Contr. Gray Herb. Harv. 1959 : No. 185 : 3–95.

The paper provides descriptions of groups and species of *Salix* in the above region, together with identification keys.

4497 Toda, R., Nakamura, K. & Satoo [Sato], T.
**The heritability of tree height and stem girth in *Cryptomeria* through sexual reproduction.**
Silv. genet. 1959 : **8** : 43–49.

Heritability in the narrow sense, i.e. based upon additive genetic variance, was determined for tree height and stem girth in 20-year old progenies of six mother trees; the results were in both cases about 25%. Comparing these figures with other estimates of heritabilities in the broad sense [cf. 770], it is concluded that the effect of selection for tree height and stem girth with sexual reproduction will be about one half or one third of that obtained with vegetative reproduction.
Since the additive genetic variance, which is determined by the number of effective genes, is smaller than the nonadditive portion determined by the effects of dominance or epistasis, it is important that attention be paid to these effects in the breeding of forest trees. It is suggested that dominance is responsible for the greater part of the nonadditive genetic variation and hence heterosis may be expected to have important effects.

4498 Minckler, L. S. & Ryker, R. A.
**Color, form and growth variations in eastern red cedar.**
J. For. 1959 : **57** : 347–49.

Seed of *Juniperus virginiana* from eight widely separated localities in the USA has been planted in southern Illinois and a report is presented on the genetic variations observed after six-years growth. It was found that the tree characteristics of a given seed source were remarkably

constant from plot to plot in Illinois but marked differences were found between sources. The colour of the winter foliage ranged from green through purple to brown and crown form ranged from almost cylindrical to broadly conical, whilst average crown volume varied between 1·1 and 5·9 cu. ft. The survival range was from 16 to 97%. The leaves of some types were almost all appressed and scale-like whilst others had varying proportions of sharp-pointed leaves. Galls of cedar apple rust (*Gymnosporangium*) were found on trees from all sources but the local Illinois source showed the greatest resistance to this disease.
The best progeny came from seed collected from six large trees in the Lebanon Forest in Wilson County in north-central Tennessee. These trees were the largest and the greenest in winter, survival being 92% after 6 years. The trees were broadly conical with mostly scale-like leaves. This progeny is good for Christmas trees, lumber and posts.

4499 Nienstaedt, H.
**Height growth is indicative of the relative frost resistance of hemlock seed sources.**
Tech. Notes Lake St. for. Exp. Sta. 1958 : No. 525 : p. 2.

*Tsuga* material from 17 different sources showed a close positive correlation (*a*) between amount of frost injury when grown at Rhinelander, Wis., and the length of the growing season at the place of origin and (*b*) between amount of frost injury and total elongation under controlled conditions of 15 hr. day and 17° C. Previous work has shown that elongation is primarily a funtion of the duration of growth at the place of origin.

4500 Nishimura, S.
**(The characteristics of seedling trees raised from seed of *Sequoia sempervirens* obtained from California. II.).**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 227–32. [Japanese].

Variation in branching habit in 12 trees grown from imported seed is described [cf. 772].

4501 Schütt, P.
Züchtung mit Kiefern. Teil II. Kreuzungen, Resistenzzüchtung und Zytologie.
**(Breeding with pines. Part II. Crossing, resistance breeding and cytology).**
Mitt. BundForschAnst. Forst- u. Holzw. Reinbek b. Hamburg 1959 : No. 42 : Pp. 40.

In this detailed review of the literature on breeding work carried out with *Pinus*, the following topics are covered: interspecific and intraspecific crosses, selfing, breeding for resistance to fungi, insects and unfavourable environmental factors and the cytology of *Pinus*.

4502 Matthews, J. D. & McLean, C.
**Improvement of Scots pine in Britain by selection and breeding.**
Forestry Commission, London 1957 : p. 14.

Three stages are involved in the breeding work of the Forestry Commission, the first being the classification of stands as sources of seed, the second, the selection and propagation of plus trees, and the third, intraspecific and interspecific crossing.

4503 Om stamträd och plusbestånd. (**Parent trees and plus stands**).
Tidskr. Lantm., Helsinki 1959 : **41** : 8–10.

In Finland, selection of pine and spruce trees for seed production, progeny testing and use in crossing has been in progress since 1947; so far, about 2000 trees have been registered. Plus stands for use in seed production have also been identified. The chief characters taken into account are height, width and evenness of the crown and freedom from disease.

4504 **1956 Annual Report, Southern Forest Experiment Station.**
US Dep. Agric. 1957 : Pp. 110.

At Crossett, Ark., *Pinus elliottii* x *P. echinata* hybrids showed twice the survival rate of *P. elliottii* controls after two years in the field, and several showed marked vigour and were taller than any of the controls. At Alexandria, La., crosses have been effected between *P. palustris* and *P. elliottii*. In comparative tests of large, average and small seedling selections from nursery beds at Crossett, the largest showed the greatest survival but after two years their superiority in height over the controls had declined from 100 to 84%. Marked differences in survival have been found among four-year-old *P. echinata* trees of different provenance. X-irradiated material is under study at the Southern Institute of Forest Genetics and at Crossett.

4505 Fielding, J. M. & Nicholson, D. I.
**A hybrid between *Pinus patula* and *P. greggii*.**
Aust. For. 1956 : **20** : 104–05.

A tree of *P. patula* pollinated by *P. greggii* yielded seeds having 70% germination capacity and showing more rapid growth than open-pollinated seed of either parent; the lower rate of growth of the open-pollinated progenies may

however have resulted from the probably high degree of selfing occurring in the rather isolated parents. The hybrids were intermediate between the parents in foliage characters.

4506 McWilliam, J. R.
**Interspecific incompatibility in *Pinus*.**
Amer. J. Bot. 1959 : **46** : 425–33.

Observations on pollinated and unpollinated ovules of *P. nigra* indicated that growth of the pollen tubes in the nucellus was necessary for the continued development of the ovules. In unpollinated ovules, the megaspore disintegrated about one month after the strobilus became receptive. It is suggested that degeneration resulted from lack of a growth factor, whose production depended upon the stimulus of pollen-tube growth in the nucellus. In *P. elliottii* x *P. nigra*, the pollen germinated but the tubes did not penetrate the nucellus. In the other three crosses studied, *P. resinosa* x *P. rigida*, *P. nigra* x *P. rigida* and *P. resinosa* x *P. nigra*, tubes were observed in the nucellus in a small percentage of the ovules. *P. nigra* x *P. resinosa* was singled out for detailed embryological investigation. The behaviour of the pollen grains could be classified as follows: (1) no germination, (2) germination with slow and ineffective tube growth, and (3) germination followed by normal, vigorous growth of the tube. Categories (1) and (2) accounted for the condition of the grains in about 70% of the ovules. These ovules began to break down as early as two months after pollination. Ovules in which tube growth was vigorous also aborted, although they continued to develop normally for a much longer period. Except in timing, the course of ovule disintegration resembled that observed in pollinated ovules of *P. nigra*; it is therefore suggested that abortion in this cross was also due to lack of a specific growth factor. Chemical analysis of ovules of *P. nigra* and *P. resinosa* revealed interspecific differences in concentrations of aminoacids, particularly arginine. These differences may have affected the functional capacity of the *P. nigra* pollen.

4507 Langlet, O.
**A cline or not a cline—a question of Scots pine.**
Silv. genet. 1959 : **8** : 13–22.

Wright and Baldwin grouped the Scots pine into geographic ecotypes in much of its European range; they considered the variability of the species to be discontinuous [cf. XXVII, 3485]. However, it is now shown that the data published by Wright and Baldwin support the theory that "the variability in question is continuous in the same degree as the determinative environmental factors vary continually". For example the variability in dry matter of the needles and the height increment appear to vary continuously and are related to the length of the first day with a normal average temperature of + 6° C. in the native habitats.
Stress is laid on the importance of estimating the relationships between characters such as winter hardiness and growth rate and the factors to which the plants are adapted. The variability of the species should be considered when the transfer of seed from a mature stand to a place with different climatic conditions is contemplated.

4508 Squillace, A. E. & Bingham, R. T.
**Localised ecotypic variation in western white pine.**
For. Sci. 1958 : **4** : 20–34.

Ecotypic variation was studied in progenies from controlled crosses and wind pollination of 45 *Pinus monticola* parents selected for blister-rust resistance and in nonresistant progenies from control seed. The eight parental localities lay within an area 30 miles across in northern Idaho and western Montana and included good, moist sites at low altitudes and poorer, dry sites at high elevations. Progenies from the former areas grew more rapidly than those from the latter when planted on good sites, their foliage had a higher dry-matter content and their seeds tended to have a low osmotic pressure. When planted at high altitudes, progenies from high-lying sites grew relatively more rapidly than those from low-lying areas. It is suggested that where topography is highly variable and growing-season moisture is a critical factor, differences in seedling establishment and growth rate have a selective influence and hinder gene-exchange between trees adapted to widely different though adjacent areas.

4509 Kozdon, P.
La selección de semillas de pino insigne y otras especies forestales. (**Seed selection in *Pinus radiata* and other forest species**).
Chile maderero 1955 : **5** : No. 3 : 1, 3, 9.

It is estimated that not less than three races of *P. radiata* exist in Chile, distinguished by their degree of branching and other morphological characters. A further race with few and fine branches and uniform growth has been found in Sierra Ventana in Argentina. The importance of seed selection in this and other species is discussed.

4510 Wright, J. W. & Gabriel, W. J.
**Effects of continuous bagging of white pine cones.**
Sta. Pap. Northeast. For. Exp. Sta. 1957 : No. 99 : Pp. 6.

On trees heavily infected with cone insects, continuous enclosure of flowering branches in sausage casings, from pollination until maturation, gave higher cone sets than were obtained on unbagged branches in *Pinus strobus*, *P. flexilis* and, in certain years, in *P. ayacahuite* and *P. peuce*. Bagging slightly decreased set in *P. griffithii* and *P. monticola*.

4511 McWilliam, J. R.
**Bioelectrical phenomena in relation to pollination in *Pinus*.**
Silv. genet. 1959 : **8** : 59–61.

The terminal bud and strobilus of *P. nigra* were found to be electropositive in relation to more basal regions of the stem and a high percentage of the pollen was found to carry a negative electrostatic charge. However there was no evidence that electropotential gradients set up between the pollen and the strobilus direct the pollen to the micropyle.

4512 Fowler, D. P.
**A summer field grafting technique for pine.**
For. Chron. 1959 : **35** : 30–35.

Details are given of a method of cleft grafting *Pinus* spp. late in the growing season, using the current year's growth for scion and stock. The technique was devised in connexion with breeding at the Southern Research Station, Maple, Ont.

4513 Håkansson, A.
**Seed development of pine grafts.**
Bot. Notiser 1959 : **112** : 65–72.

A record is presented of embryological investigations made on grafted pines from different localities in central and northern Sweden by means of X-ray photography. Grafts in the more northern localities tended to be delayed in fertilization and seed development and to have smaller embryos and seeds. In addition, their seeds were often polyembryonic. Delay in fertilization was however also noted in some grafts from the more southern districts.

4514 Brown, A. G.
**A simple pollen viability test.**
Aust. For. 1958 : **22** : 10–12.

The following method was found to be satisfactory for determining pollen viability in *Pinus*. A slide was supported in a Petri dish about 5 mm. above the bottom by two small pieces of wood. The pollen was dusted on to the slide and sterilized water added to a depth of 1·2 mm. The preparation was kept at about 25° C. for 72 hr., after which viability was determined by counting the grains whose diameter was less than the tube length. Application of cotton blue at the time of examination facilitated counting.

4515 Duffield, J. W. & Callaham, R. Z.
**Deep-freezing pine pollen.**
Silv. genet. 1959 : **8** : 22–24.

The study described shows that pollen stored in a deep freezer is still viable in the following season.

4516 Rudolph, T. D., Libby, W. J. & Pauley, S. S.
**Jack pine variation and distribution in Minnesota.**
Minn. For. Note 1957 : No. 58 : Pp. 2.

A preliminary survey of *Pinus banksiana* has indicated that the cones show a clinal change from the type with appressed scales in the north east to the spreading type in the south east. Several instances of apparent resistance to the budworm *Choristoneura pinus* and the rust *Cronartium cerebrum* were found.

**Multiple-use forestry in the changing West.**
Proceedings of the Society of American Foresters Meeting held in Salt Lake City, Utah from September28 – October 2, 1958 (1959) : Pp. 215.

4517 *Echols, R. M. Evaluating trees and stands from large increment cores. (pp. 145–47).*

Cores 10 mm. in diameter taken at a height of 3 ft. from the base of the tree are more useful than the usual 4 mm. cores in assessing such characters as specific gravity, fibre length, fibril angle, presence of reaction wood, moisture content and yield of pulp per unit volume of wood. Reference is made to the application of the method in pine breeding.

4518 Schütt, P.
Über Aussichten und erste Massnahmen einer züchterischen Bekämpfung der Kiefernschütte. (**Prospects and initial measures for controlling *Lophodermium pinastri* on pine by breeding**).
Allg. Forstzeitschr. 1957 : **12** : No. 2 : 13–15.

Work in Hessen, Lower Saxony and Schleswig-Holstein during the past five years has been

concerned with the selection of healthy trees from infected areas, their propagation under infected conditions for 2–3 years and the further testing of the most resistant under conditions of even more severe attack. Eleven highly resistant and 174 resistant trees have been found so far. Further problems discussed include the possibility of the occurrence of different biotypes of the pathogen in different areas and of different geographical races of pine.

4519 Wright, J. W. & Gabriel, W. J.
**Possibilities of breeding weevil-resistant white pine strains.**
Sta. Pap. NE For. Exp. Sta. 1959 : No. 115 : Pp. 35.

Studies exploring the possibilities of developing strains of white pines resistant to the white-pine weevil (*Pissodes strobi*) were begun in 1952. They included the examination of ten introduced white pine species and investigations of geographic and local variations and individual tree variation in eastern white pine (*Pinus strobus*).

So far, western white pine (*P. monticola*) shows most promise as a source of weevil resistance. It has good climatic adaptability, growth rate and bole form. However, it is susceptible to blister rust (*Cronartium ribicola*), but it crosses easily with the eastern white pine. In the following order, Himalayan white pine (*P. griffithii*), Macedonian white pine (*P. peuce*) and Mexican white pine (*P. ayacahuite*) are the next most promising introduced pines.

In the studies of eastern white pine, a small unreplicated provenance test showed that trees of Ontario were less damaged by weevils than trees of New York provenance. The presence of extreme differences in weevil incidence among three genetically similar plantations located near one another indicates that apparently resistant local races would be difficult to recognize in the field. The study of individual eastern white pine trees showed that weevil attack in one year is generally not associated with attack in the preceding year.

The development of a weevil-resistant strain by intraecotypic selection and breeding within eastern white pine does not appear to be possible. The testing of different geographic ecotypes within that species holds more promise but is still in the early stages. Western white pine and probably some other introduced five-needled pines contain enough resistance to form the basis of weevil-resistant strains with desirable growth characters.

4520 Holmgren, A.
Några anmärkningsvärda tall- och granformer. (**Some noteworthy forms of pine and spruce**).
Svenska SkogsvFören. Tidskr. 1959 : **57** : 9–42.

Descriptions of the following aberrant forms of *Pinus sylvestris* and *Picea abies* found in Sweden are given: bush pine, in which branching begins near the base of the stem, apical dominance is very weak and the branches fork repeatedly; pines with twisted trunks; acroconal spruces in which there is a tendency for the terminal shoots to become cones; dichotype spruce; and an example of a bud variation in spruce, consisting of a single normal branch on a snake spruce. Cone and seed production in the bush pine are low. Both the bush character in pine and acroconal growth in spruce appear to be heritable.

4521 Aass, I.
En cytologisk analyse av Skjåkfurua. (**A cytological analysis of Scots pine from Skjåk**).
Med. Skogsforsøksv. 1957 : **14** : 93–109.

A stand in Skjåk in southern Norway includes creeping and erect short-needled shrubs and dwarf trees with needles of varying length; it has given progenies containing the same aberrant forms. Twenty-four abnormal trees studied cytologically were all diploid with $2n = 24$ and resembled normal trees in caryotype, but several showed a higher frequency than normal of chromatin bridges and diploid pollen grains.

4522 Ruden, T.
Arvelige dvergformer av furu (*Pinus silvestris* L.) fra Skjåk, Gudbrandsdal. [**Hereditary dwarf forms of Scots pine (*P. silvestris* L.) from Skjåk, Gudbrandsdal**].
Medd. Skogsforsøksv. 1957 : **14** : 413–43.

Seed progenies from Skjåk, Norway, planted in provenance trials at Matrand, showed a low survival rate and included a high percentage of aberrant forms. Similar misshapen trees were observed in the parental area, indicating that the defect is heritable. [Cf. 4521].

4523 Tralau, H.
Beiträge zur Kenntnis der Variabilität der Fichte. III. Farbcharakteristika. (**Contributions to the knowledge of variation in the spruce. III. Colour characteristics**).
Phyton, Vicente López 1958 : **11** : No. 1 : 63–74.

Observations are reported on the content of

chlorophylls a and b and of carotenoids in the cotyledons of normal *Picea* seedlings and of others with abnormal pigmentation; the relative proportions of the different pigments varied during development in different ways in the different types of seedling. [Cf. XXVIII, 2293].

4524 Bouvarel, P. & Lemoine, M.
Races de mélèze et grosseur des graines. (**Larch races and seed size**).
Rev. for. franç. 1958 : **10** : 348–50.

Seeds of larches from Briançon (1200–1700 m. above sea level) were much larger than those from Austrian larches (300–1200 m.), with no overlap between the two ranges in size. Larches from the Sudeten and Poland had even smaller seeds than those from Austria.

4525 Kučerenko, V. D.
(**A larch in the Orenburg steppe**).
Priroda (Nature), Leningrad 1959 : No. 4 : 100–01. [Russian].

A tree of *Larix sibirica*, at least 450 years old, was found growing and fruiting under the severe climatic conditions of the Transural. It bears cones at intervals of 2–3 years and it is thought that it might give rise to progenies resistant to drought and soil salinity.

4526 Campbell, R. K.
**Variations in crown form attributes in populations of *Pseudotsuga menziesii* (Mirb.) Franco (Douglas fir).**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–7350 : 1497–98. (Abst.).

The following crown characteristics were studied in 300 trees aged 20–40 years and growing in ten districts in the south-western part of Washington State: length and volume of a predetermined portion of the stem; number, length and angle of the branches; and cross-sectional area of branch bases. Information is given on variation (1) within individual trees, (2) between trees in the same area and (3) according to area, and also on the relationships between characteristics of the crown. Possible patterns of geographical variation were deduced from adjusted area mean values for branch number and length and cross-sectional area of the branch bases. "In relation to this, the difficulty of ascribing these phenotypic differences between areas to hereditary causes is discussed."

4527 Veen, B.
Het herkomstenvraagstuk bij de groene douglas. (**The provenance problem of Douglas fir**).
Ned. BoschbTijdschr. 1958 : **30** : No. 2 : 44–46.

Provenance trials have indicated that the best types for Netherlands conditions come from low-lying maritime areas in south-west Washington. These forms flush later than those from higher altitudes and are thus less liable to damage by night frosts. Early flushing is also correlated with susceptibility to *Rhabdocline.*

## VEGETABLES

4528 Nonnecke, I. L.
**Yield variability of sweet corn and canning peas as affected by plot size and shape.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3815 : p. 627. (Abst.).

"In 1956 weights of marketable ears of sweet corn from three uniformity trials, and in 1957 vine and shelled pea weights of canning peas from two uniformity trials, were recorded to determine the effect on yield variability of varying plot and block sizes and shapes.

"The coefficients of variation for sweet corn decreased with increased plot size. For blocks $1 \times 6$ plots and blocks $3 \times 2$ plots widening the plots was more effective in reducing variation than lengthening them. However, for blocks $6 \times 1$ plots and blocks $2 \times 3$ plots lengthening the plots was most effective. For canning peas the coefficients of variation for both vines and shelled peas showed an overall reduction as plot length increased. The steadiest reduction in variation occurred in blocks $1 \times 6$ plots.

"Estimates of cost were obtained showing the percentage of the total cost that was proportional to the number of plots used and the percentage that was proportional to the total area used per treatment. Optimum plot size for sweet corn was found to be one or two basic units (10 feet by 6 feet or 20 feet by 3 feet) depending upon cost assumed and the value of the regression coefficient. For canning peas the optimum plot size was found to be one basic unit (5 feet by 10 feet).

"Optimum size of plot for yield of sweet corn provided sufficient kernels for quality studies. However, for canning peas considerably more shelled peas were required for processing than can be obtained from the optimum size of plot for yield.

"Smith's method for determining optimum size of plot agreed with the coefficients of variation method as to optimum size of plot for both sweet corn and canning peas."

[Author's summary].

4529 Barbieri, R. & La Rotonda, C.
Aspetti biologici e tecnologici del miglioramento delle piante ortive di interesse per l'industria conserviera meridionale. (**Biological and technical aspects of breeding garden plants of interest for the conserving industry in the south**).
Sementi elette 1959 : **5** : No. 3 : 35–48.

In a survey of the problems confronting the vegetable breeder in southern Italy, further reference is made to the confusion existing as to the true identity of the tomato San Marzano [cf. XXVI, 2922] and to breeding work that is being carried on to reconstitute it in its authentic form. Different strains of the cultivar Lampadina have displayed differences in the extent to which they are subject to tip rot, malformation of fruit and suitability for peeling. Several hybrids and selections suitable for the production of concentrates are mentioned, local varieties from southern Italy and their selections having proved superior to the large-fruited varieties from northern Italy, which have a higher acidity. Selection of varieties suitable for making tomato juice is being carried out and the cultivars that have proved best as table varieties are enumerated.
The most popular cultivars of pea and French bean are also named.

4530 Norges Landbruksvitenskapelige Forskningsråd. Årsmelding for budsjettåret 1957–58. (**The Agricultural Research Council of Norway. Annual Report for the fiscal year 1957–58**). 1958 : Pp. 156.

In a brief account of current horticultural research, mention is made of trials and breeding of fruits and vegetables at various stations. A new melon, Norderås 7, and two new tomatoes, Norderås busk [Norderås Bush] and Rugosa busk [Rugosa Bush] have been developed. Sources of resistance to club root in cabbage have been found in some German varieties.

4531 Hagiwara, T.
(**The cultivation and management of vegetables. VII**).
Nogyo oyobi Engei/Agric. & Hort. 1956 : **31** : 1031–35. [Japanese].

Trials of varieties and $F_1$ hybrids of cucumbers, tomatoes and egg plants are reported. Data are reported on yield, agronomic characters and, in some cases, disease resistance.

4532 Nya köksväxtstammar. (**New vegetable strains**).
Weibulls Allehanda 1958 : **18** : 48–51.

***Capsicum.*** A yellow, large-fruited sweet pepper, Grenoli, developed from Italian material, is being released. It is midearly and suited to Swedish conditions.
**Beetroot.** The new beetroot Adoptiv is almost round, has a smooth skin, narrow neck and uniformly red flesh and ranked highest in cooking tests for tenderness and flavour.
**Radish.** Amager oval vinter W : s/56 [Amager Oval Winter W : s/56], selected from a previous strain of the same type, yields long red roots of which a high proportion is marketable. Saxa vinter W : s/56 [Saxa Winter W : s/56] produces bright red round roots and equals Rubin vinter W : s/56 in earliness and quality. Both strains have been awarded first-class rank in official trials.
**Leek.** Erda Perfekt, intended as an autumn and winter variety, is vigorous in growth, long stemmed and productive; its winter hardiness is less satisfactory.
**Dill.** Selected from common dill, the new Variety Arom [Aroma] grows more rapidly than the initial material and yields about 10% more.

4533 Tilkin, V. E.
L'obtention de variétés hybrides en culture maraîchère. (**Obtaining hybrid varieties in market garden crops**).
Rev. Agric., Brux. 1958 : **11** : 1678–80.

Notes are provided on the production of $F_1$ hybrid seed of plants with four different kinds of floral biology.

4534 Zorn, C.
Neue Gemüsesorten. (**New vegetable varieties**).
Mitt. dtsch. LandwGes. 1959 : **74** : Nos. 15–16 : Reich Landfrau 1959 : **15** : 117–18 : **16** : p. 126.

Brief descriptions are provided of recent varieties of radish, beetroot, dwarf, runner and broad bean, pea, marrow, white, Savoy and red cabbage and cauliflower. Names and addresses of the breeders concerned are included.

4535 Kiričenko, L. I.
(**New valuable forms of carrot and other vegetables with flavoured roots in the collection of the Institute of Plant Industry**).
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 74–75. [Russian].

A number of cultivars of carrot, parsnip, celery,

celeriac and parsley, which are interesting for productiveness or high quality of roots or stems, are named. Most of them originated from Europe.

4536 Lukašuk, N. P.
**(Chinese radish, a valuable vitaminiferous vegetable).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 4 : p. 32. [Russian].

This crop is valued in the Soviet Far East for its vitamin C content, good flavour and keeping quality. The varieties Oktjabr'skaja 1 [October 1], Rozovaja Kitajskaja [Pink Chinese] and Mestnaja Zelenaja [Local Green] cross readily with one another and with other forms of radish.

4537 Nakamura, N. & Terabun, M
**(Studies on seed production of the onion. II. Genotypic correlations of mother plants).**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1956 : **2** : 174–76. [Japanese].

Phenotypic correlations between characters, parent-offspring correlations and genotypic correlations were determined from a study of mother plants and open-pollinated offspring of the variety Senshuko [Izumi Yellow]. The characters studied were lodging date, stem length, and height/diameter ratio, neck diameter and weight of the bulb. The following genotypic correlations were significant: lodging date and stem length, 0·6719; lodging date and neck diameter, 0·5796; lodging date and bulb weight, 0·6260; stem length and height/diameter ratio of the bulb, — 0·9999; stem length and neck diameter, 0·5875; height/diameter ratio and neck diameter, — 0·6235; and neck diameter and bulb weight, 0·7266. Selection based on date of lodging is therefore likely to modify stem length and bulb characters.

4538 Nakamura, N.
**Studies on the breeding of *Allium cepa*, L. (1) Estimating heritability.**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 255–60.

In continuation of the work reported above [4537], attempts were made to estimate the heritabilities of stem length and diameter, lodging date, height/diameter ratio of the bulb and bulb weight of the variety previously studied from the parent-offspring and half-sib covariances. However, it appeared that the half-sib covariance included a genotype-environment interaction component in the case of all characters except stem length; for the latter character heritability was estimated from the half-sib covariance as 0·35–0·41. Heritabilities for the other characters were estimated from the parent-offspring covariances as follows: stem diameter, 0·17; lodging date, 0·78; height/diameter ratio of the bulb, 0·32; and bulb weight, 0.

4539 Peregudt, M. F.
**(The onion variety Jalta 6).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 4 : p. 32. [Russian].

Jalta 6 was selected from a local Crimean variety, which was nearly lost during the war, at Simferopol'. It ripens in one year, even when sown in the open. The bulbs are large, tender, juicy and of a nonpungent kind suitable for salads. It has a short dormancy period and a growth period of 138–150 days and yields up to 541 c. per ha. Selection aiming at improvement of keeping quality and the elimination of plants tending to branch is in progress.

4540 Průša, V., Prugar, J., Jiránek, J., & Omasta, J.
Zhodnocení československých odrůd cibule na podkladě chemických rozborů.
**(An evaluation of Czechoslovakian onion varieties based on chemical analyses).**
Sborn. čsl. Acad. Zeměd. Věd : Řada rostlinná Výroba 1959 : **32** : 513–20.

A series of onion varieties grown in Czechoslovakia were analysed chemically. As regards chemical composition, Všetatská onions grown from sets were the best. The culinary and keeping qualities of the varieties tested are discussed.

4541 Marlatt, R. B. & McKittrick, R. T.
**Pink-root resistant onions for Arizona.**
Plant Dis. Reptr. 1958 : **42** : 1310–11.

All onion varieties tested showed infection by *Pyrenochaeta terrestris*. Granex showed significantly more infection than Excel, Texas Hybrid 28, Eclipse and L365, but is tolerant of injury; it gave higher yields of larger bulbs, and showed the least amount of decay in storage.

4542 Khoshoo, T. N. & Sharma, V. B.
**Cytology of the autotriploid *Allium rubellum*.**
Chromosoma 1959 : **10** : 136–43.

A triploid form of *A. rubellum* with the chromosome number $2n = 24$ was collected in Pathankot, India. The chromosomes all have a median or submedian centromere and six have a secondary constriction. These six chromosomes do not

form three clearly homologous pairs. During meiosis, multivalents, bivalents and univalents were observed; trivalents were most frequent, some cells having eight. The distribution at anaphase I was irregular and laggards, bridges and fragments were noted. The triploid is sterile but maintains itself by efficient vegetative reproduction.
From these results it is concluded that this form is probably an autotriploid of intervarietal origin.

4543 Ownbey, M. & Aase, H. C.
**_Allium speculae_, a new species of the _Allium canadense_ alliance from Alabama.**
Rhodora 1959 : **61** : 70–72.
An additional member of the *A. canadense* alliance is described [cf. XXVI, 2883].

4544 Perron, J. P., Jasmin, J. J. & Lafrance, J.
**Varietal resistance of seeded onions to the onion maggot, _Hylema antiqua_ (Meig.) (Diptera : Anthomyiidae).**
Canad. Ent. 1958 : **90** : 653–56.
Among 44 varieties of *Allium* species grown from seed and tested in the field and greenhouse during 1955–57, *A. fistulosum* varieties, in particular Hishiko and one referred to as Nebuka, were more resistant than *A. cepa* varieties. Beltsville Bunching, from *A. cepa* x *A. fistulosum*, was moderately susceptible.

4545 Huyskes, J. A.
**A method for selecting asparagus varieties with a long fibreless top.**
Euphytica, Wageningen 1959 : **8** : 21–28.
A method of selection is described, based on bending the asparagus spear until it breaks, so that the break occurs at the point of junction between the upper fibreless portion and the lower fibrous part. In 1958, plants with a fibreless top 30% or more above the average in length were selected, forming about 1% of the population. The method can be applied to green spears only, and it is suggested that for blanched asparagus the crop be grown green for one year to allow selection. Depth of planting affects the length of the fibreless part and should be taken into account.

4546 Grogan, R. G. & Kimble, K. A.
**The association of _Fusarium_ wilt with the asparagus decline and replant problem in California.**
Phytopathology 1959 : **49** : 122–25.
At Davis, California, breeding lines of asparagus selected for longevity, were tested for resistance to *F. oxysporum* f. *asparagi*; the few surviving plants were crossed and the $F_1$ progenies tested. In one such test only 4·3 % of the $F_1$ progeny survived but this was a considerable improvement on the performance of the parental material. Selection for resistance is continuing.

4547 Jacoboni, N.
Il carciofo Romanesco. (**The Roman artichoke**).
Ann. Fac. Agr. Perugia 1958 : **13** : 342–72.
Information is given on the origin of the globe artichoke, and on the various views that exist concerning the classification of *Cynara scolymus* and related species and of the cultivars. An account is given of the floral biology; cross pollination with other botanical varieties or species, such as the cardoon, *C. cardunculus*, is not excluded. The famous Roman artichoke is identified with the cultivar of Campagnano, though another, that of Castellamare, which is earlier but inferior in quality, is also described.

4548 Josefsson, A.
Förädling av raps- och kålfoderväxter. (**Breeding of rape and kale fodder crops**).
Sverig. Utsädesfören. Tidskr. 1959 : **69** : 58–71.
Breeding objectives and results so far obtained in developing rapes and kales for fodder in Sweden are outlined. In winter rape the aims are a high yield of green matter, high protein content and low content of crude fibre. Among ten synthetic rapes from turnip rape x cabbage, several have surpassed Matador in yield of green matter and are leafy, with a desirable ratio between leaf and stem mass; some lines are winter hardy and give good seed sets. Most strains are rather uniform, but the possibility of improvement by mass selection or family breeding is being studied. Segregating populations have been obtained from crosses of hardy Swedish varieties with foreign types with high green-matter yields.
In fodder kales, leafy types with tender stems which retain their leaves well are required, together with a decrease in mustard oil and the maintenance of satisfactory winter hardiness. Populations from crosses between marrow-stem kale, broccoli, Brussels sprouts and other types are under study. Induced tetraploids are being used in crosses; their seed set is good but that of triploids is poor.
Among summer oil crops, only late types are being used in breeding since these are best as fodder plants. The breeding material includes: lines from a cross between the mustard Fiskeby and an artificially synthesized form of Indian

mustard; some very late summer rape forms from a cross between an English winter rape and an artificial Japanese strain; and a late Italian summer rape.

4549 Hagiya, K. (Translator).
**(Genetics of the cabbage group).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 713–16, 865–67. [Japanese].
[Cf. XXVI, 2887].

4550 Nishi, S., Kawata, J., & Toda, M.
**[On raising interspecific *Brassica* hybrids combining the c genome (cabbage group) and a genome (*B. pekinensis* group) by means of embryo culture].**
Ikushugaku Zasshi/Jap. J. Breeding 1959 : **8** : 215–22. [Japanese].
Crosses between *B. pekinensis* ♀ and *B. oleracea* ♂ produced only a few matroclinous seedlings. Crosses between *B. oleracea* ♀ or (*B. alboglabra* x *B. oleracea*) ♀ and *B. pekinensis* ♂ produced a few matroclinous seedlings in pods left on the mother plant but some true hybrids were obtained when the embryos were excised and cultured on a modified White's medium. The hybrids are regarded as promising material for breeding new *Brassica* types.

4551 Nakagawa, H., Kamimura, S., Sato, I., & Henmi [Hemmi], S.
**(The breeding history and characteristics of the new *Brassica pekinensis* varieties Asahi and Michinoku).**
Tohoku Nogyo Shikenjo Kenkyu Hokoku/Bull. Tohoku agric. exp. Sta. 1958 : No. 13 : 64–72. [Japanese].

Nakagawa, H., Kamimura, S., Sato, I., & Hemmi, S.
**(The new *Brassica pekinensis* varieties Asahi and Michinoku).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1093–094. [Japanese].
Asahi [Rising Sun], a selection of Chiba 1 x Kashin, registered as Norin 1 (Ministry of Agriculture and Forestry 1], resembles Kashin; it is moderately resistant to soft rot and viruses. Michinoku, a selection of Hakushokuhotoren x Matsushima 2, registered as Norin 2, resembles Matsushima 2 but has improved resistance to soft rot and viruses.

4552 Wiering, D.
**Artificial pollination of cabbage plants.**
Euphytica, Wageningen 1958 : **7** : 223–27.
This is a translation of a Dutch article already summarized [3184].

4553 Boek, K., & Schuphan, W.
Der Nitratgehalt von Gemüsen in Abhängigkeit von Pflanzenart und einigen Umweltfaktoren. **(The nitrate content of vegetables in relation to the species and some environmental factors).**
Qual. Plant Mater. veg. 1959 : **5** : 199–208.
The nitrate content of white, red and Savoy cabbage varieties investigated at Geisenheim is recorded. In an experiment with normal fertilizer treatment, values ranging between 27 and 87 mg. % were found in fresh material, the average being 50 mg. %.

4554 Marukawa, S.
**(New varieties of cabbage suitable for growing under snow and considerations on their cultivation).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1047–50. [Japanese].
Descriptions are given of a series of recently bred Japanese varieties suitable for growing under snowbound conditions in the prefectures of Fukui, Ishikawa and Toyama. Data are provided on origin, size and firmness of the heads and winter hardiness.

4555 Nieuwhof, M.
Rand in Herfstwitte. **(Tipburn in Herfstwitte).**
Zaadbelangen 1959 : **13** : 88–90.
Differences in incidence of the above disorder, causing discoloration of the margins of the inner leaves, have been observed among strains and varieties of cabbage, Roem van Enkhuizen [Enkhuizen Glory] and Succes being resistant and Langendijker Herfstwitte [Langendijk Autumn White] susceptible. Selection for low incidence is being carried out in the last-mentioned variety, using early sowing, high nitrogen fertilization and late harvesting, conditions under which the disorder is most frequent.

4556 Daniel, G. H.
**Early cauliflower trials, 1954–57.**
J. nat. Inst. agric. Bot. 1958 : **8** : 423–32.
The results of 16 trials carried out at six centres in England are presented. The varieties tested were Early Snowdrift Improved, Cambridge 7, Finney's 111, Pioneer, Cambridge 8 and All the Year Round.

4557 Mahoney, D. L., Janick, J. & Stevenson, E. C.
**Sex determination in diploid-triploid crosses of *Spinacia oleracea*.**
Amer. J. Bot. 1959 : **46** : 372–75.
The diploid variety Nobel was crossed with a

colchicine-induced tetraploid of the variety Long Standing Bloomsdale and produced triploid progeny consisting of 55 staminate and 13 pistillate plants. Nine of the triploid staminate progeny were crossed with diploid pistillate plants. Progenies of three of these crosses consisted of a total of 260 staminate and 105 pistillate plants, i.e. 2·5 ♂ : 1 ♀; the other six crosses gave 348 staminate and 466 pistillate plants (0·7 ♂ : 1 ♀). The sex ratio of the $2n$ ♀ x $3n$ ♂ cross depends on the type of staminate plant, i.e. duplex (XYY) or simplex (XXY), and the viability of the types of pollen produced. If only $n$ gametes were viable, the expected sex ratio would be 2 ♂ : 1 ♀ from a duplex cross and 1 ♂ : 2 ♀ from a simplex cross, whereas disregarding possible differences in viability between gametes ($n$, $n + 1$ . . . $n + 6$), progeny of the duplex cross would be expected to consist of 5 ♂ : 1 ♀ and the progeny of the simplex cross to segregate 1 ♂ : 1 ♀. The observed ratios did not fit either assumption but were intermediate indicating that $n$ gametes were not the only functional type. Other genetic data also indicated that in addition to $n$ and $n + 1$ gametes other types of gamete were transmitted through staminate triploids.

Cytological analyses were carried out with progenies from a number of $2n$ ♀ x $3n$ ♂ (XYY and XXY) crosses. There were no 15-chromosome plants and there was a low frequency of 14 and 16-chromosome types. It appeared that gametes with 7, 8, 10, 11 and 12 chromosomes were viable. Although similar data were obtained for each cross, the data were not homogeneous, for the frequency of diploids produced varied from 31·4 to 91·3%. Reciprocal crosses yielded a higher percentage of aneuploid types, including 1·7% with 15 chromosomes.

The expected sex-ratios for progenies with different chromosome numbers were calculated assuming random chromosome pairing and assortment; the ratios were compared with observed results. In the $2n$ x $3n$ crosses, diploids from the duplex crosses segregated 33 staminate: 42 pistillate, a ratio deviating significantly from the expected 2 ♂ : 1 ♀. The excess of females is said to indicate preferential X–YY segregation in the triploid staminate parent. Sex ratios of the other chromosome types did not differ from the expected. In the simplex crosses, the diploid progeny fitted the expected ratio of 0·5 ♂ : 1 ♀ but there was an excess of staminate plants over the expected ratio of 2 ♂ : 1 ♀ in the triploids. Progenies from the triploid x diploid crosses were expected to segregate in a ratio of 1 ♂ : 1 ♀ but progeny with 17 chromosomes segregated 13 staminate: 1 pistillate; other observed ratios corresponded to the expected.

The above observations are discussed in relation to investigations of fertility in autotriploids of other plants.

The lack of pistillate plants in the triploid progeny of the $2n$ (XX) ♀ x $3n$ (XYY) ♂ crosses indicates that chromosome rather than chromatid segregation occurs. "This suggests that the sex-determining gene is either located near the centromere or that the gene for sex behaves as a chromosomal unit and not as a single gene". It was also noticed that increased vigour was associated with the triploid condition.

4558 O'Brien, M. J. & Webb, R. E.
**Preservation of conidia of *Albugo occidentalis* and *Peronospora effusa*, obligate parasites of spinach.**
Plant Dis. Reptr. 1958 : **42** : 1312–15.

A method is described for preserving conidia of *A. occidentalis* and *P. effusa* by freezing at — 10° F. for 5–6 months. These will then infect healthy plants under greenhouse conditions and can be used at will in screening spinach varieties and segregating populations for resistance.

4559 Huyskes, J. A.
Is herhaalde terugkruising bruikbaar als veredelingsmethode voor spinazie? (**Can repeated back crossing be used as a breeding method for spinach?**)
Zaadbelangen 1959 : **13** : 124–26.

The principles and advantages of the back-crossing method are outlined and it is mentioned that the technique has been used successfully at the Netherlands Institute of Horticultural Plant Breeding to transfer dominant monofactorial resistance to *Peronospora spinaciae* to the commercial variety Viking.

4560 Porcelli, S.
Miglioramento genetico della lattuga *Lactuca Scariola* L. var. *sativa* (L). c.v. Trocadero. [**Genetic improvement of lettuce, *L. Scariola* L. var. *sativa* (L.) cv. Trocadero**].
Sementi elette 1959 : **5** : No. 3 : 71–78.

Few if any of the strains of Trocadero lettuce cultivated in southern Italy combine the desired morphological features with suitable biological characters such as freedom from bolting and time of maturity. Little or no improvement has been effected by phenotypic selection but by pure-line selection it has been possible to produce types with a large number

of leaves, a long vegetative phase, rapid flowering and low bolting percentage, combined with high leaf weight and width, freedom from excessive midrib, leaf thickness between 250 and 300 $\mu$, freedom from anthocyanin pigmentation and high content of sugars and dry matter. Line Tr. 2 is distinguished by the best combination of all these characters.

4561 Rodenburg, C. M.
**The identification of lettuce varieties from the young plant.**
Euphytica, Wageningen 1958 : **7** : 241–46.
It has proved possible to identify 150 lettuces at the three-leaf stage. As an example, an illustrated key to the ten varieties grown in the Netherlands is presented.

4562 Girenko, M. M.
**(The best varieties of lettuce and spinach which have been added to the collection at the Institute of Plant Industry in 1956–1957).**
Bjull. vsesojuzn. Inst. Rasten. (Bull. All-Un. Inst. Pl.-Industr.) 1958 : No. 5 : 76–78. [Russian].
Brief descriptions are given of lettuce cultivars recently introduced from Argentina, China, France, Germany and the Netherlands. In the trials at Puškin and Majkop most showed resistance to bolting and formed large heads of fine quality. A few Danish, Dutch and Swedish spinach varieties resistant to bolting are also named.

4563 Untersuchungen über das Blattnervenmosaik des Salats. **(Investigations on the big vein disease of lettuce).**
Diss. Landw. Fak. Univ. Giessen 1958 : Pp. 86. (Mimeographed).
The results are reported of tests of a series of German lettuce varieties; none of these showed noteworthy resistance to the big vein virus. Within varieties there was considerable variation in the severity of the virus attack, indicating that environmental factors as well as varietal characters influence the effect of the virus.

4564 Attia, M. S. ['Attiah, M. ul S.].
**Infection studies with late blight of celery.**
Ann. agric. Sci., Cairo 1957 : **2** : No. 2 : 183–89.
A "dunking" method of inoculation with late blight (*Septoria apii*), regarded as more satisfactory than the spray method in breeding for resistance, is described.

4565 Porcelli, S.
Miglioramento genetico della cicoria endivia (*Cichorium Endivia* L. var. *latifolia* Hort cv. Scarola). [**Genetic improvement of endive (*C. endivia* L. var. *latifolia* Hort. cv. Scarola)**].
Sementi elette 1959 : **5** : No. 3 : 79–82.
The endive cultivated in southern Italy is relatively uniform in biological characters but shows a fairly wide variation in morphological features. By pure-line selection it has been possible to produce lines distinguished by long vegetative period and a large number of wide leaves without a main midrib, which grow in a compact form leading to natural blanching.

4566 Thomason, I. J. & McKinney, H. E.
**Reaction of some Cucurbitaceae to root-knot nematodes (*Meloidogyne* spp.).**
Plant Dis. Reptr. 1959 : **43** : 448–50.
Data are given for the resistance of different varieties of various cucurbitous species to *M. incognita* var. *acrita*, *M. javanica* and *M. hapla*. All varieties tested were susceptible to the first two pathogens. Two populations of *M. hapla* were used and some resistance was found among cantaloupes (Rio Sweet Weslaco, Texas, Hale's Best and Rocky Ford) and winter melons (Honey Ball Pink Flesh, Honey Dew Golden Rind, Pershaw and Casaba). Squash varieties Black Zucchini and Scallop were also resistant to *M. hapla*.

4567 Shoyuko, T.
**('The cultivation of promising varieties of melon).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 463–68. [Japanese].
An account is included of the agronomic characters, disease resistance and productivity of recently introduced Japanese varieties.

4568 Daskalov, H. & Popova, D.
[**Heterosis in melons (*Citrullus edulis*) and the prospects of utilizing it in practice**].
Selskostopan. Misăl 1958 : **3** : 785–87. [Bulgarian].
An account of breeding heterotic hybrids of water melon at the Institute of Plant Industry of the Bulgarian Academy of Sciences is given and four varieties used for intervarietal hybridization and two of the best hybrids are described. Vălkovska x Mramorna 17 [Marble 17] yields appreciably more fruits and first fruits than the standard Mramorna 17 and the fruits are sweeter, though a little smaller. The other

hybrid, Välkovska x Maršovska, is even more productive of first fruits, its total yield also considerably exceeding that of the standard variety. The fruits are large and sweet. The production of $F_1$ seed of the water melon presents little practical difficulty because of the large number of seeds contained in a fruit.

4569 Winstead, N. N., Goode, M. J. & Barham, W. S.
**Resistance in watermelon to *Colletotrichum lagenarium* races 1, 2, and 3.**
Plant Dis. Reptr. 1959 : **43** : 570–77.

A large number of varieties and advanced breeding lines were tested in North Carolina for resistance to races 1, 2, and 3 of *Glomerella lagenaria*. All were susceptible to race 2; resistance to both races 1 and 3 was found in varieties Black Kleckley, Blackstone, Charleston Gray, Congo, Fairfax and Hope Diamond and in the advanced breeding lines Georgia 4, NC20, NC21 and NC22. Inheritance studies showed that resistance to races 1 and 3 of the pathogen is controlled by the same dominant gene.
Resistance to race 2 was found only in an African citron water-melon line, W–695, which is also resistant to races 1 and 3. Inconclusive results were obtained from inoculation experiments of crosses made between W–695 and Charleston Gray.

4570 Whitaker, T. W.
**An interspecific cross in *Cucurbita* (*C. lundelliana* Bailey x *C. moschata* Duch.).**
Madroño, S. Francisco 1959 : **15** : 4–13.

$F_1$ plants have been raised from the above cross, *C. lundelliana* being a Central American wild species and the variety of *C. moschata* used being Long Genoa Queen. The hybrids were moderately fertile and $F_2$ hybrids and back crosses to each parental species were obtained. In general, the $F_1$ hybrid was intermediate between the parents; the $F_2$ was, as expected, variable but the hybrid index values for the characters studied did not reach the parental values. Characters such as large fruit, soft rind, highly pigmented flesh and large seeds, which are selected by growers, tended to be recessive. It seems that, despite their considerable morphological diversity, the two species are of common origin.

4571 **(Bush-type pumpkin varieties).**
Kooper. Zemed. (Cooper. Fmg.), Sofija 1958 : No. 8 : p. 45. [Bulgarian].

The Soviet forage varieties Pena 766 [Froth 766] and Pobeda [Victory], both bred at Verhnjaja Hava, are described. They have a compact habit, short growth period and soft skin and are productive and resistant to drought.

4572 Weigle, J. Le R.
**Evaluation of $F_1$ hybrid pickling cucumbers.**
Diss. Abstr. 1959 : **19** : LC Card Mic 58–5722 : p. 1512. (Abst.).

Four varieties and their six possible $F_1$ hybrids were evaluated during 1955 and 1956 with respect to yield, infection of the fruits by mosaic, shape, length-width ratio, quality when pickled and performance in pressure tests of both the fresh and pickled fruits. Although none of the hybrids was statistically superior to the standard varieties in any one characteristic, in 1956 the hybrid SMR18–7 x MR25 was rated the best of the entries when all the criteria were considered. The hybrids had length-width ratios intermediate in most cases between those of the parents. This result suggests the possibility of utilizing as parents promising inbreds which do not however possess acceptable length-width ratios. "A hybrid can be produced with a specific length-width in one year by testing a number of such combinations. Whereas, if an attempt is made to produce a variety with a certain length-width ratio in combination with the other desired characteristics, it would probably take many years."

4573 Nakamura, N. & Maekawa, S.
**(Vegetative hybrids of cucurbits. I. On variation in cucumber scions).**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1957 : **3** : 38–43. [Japanese].

Minor differences in petal shape, floral sex ratio and disease resistance were noted in the $F_0$ generation of cucumber scions grafted on species of *Benincasa, Citrullus, Cucumis, Cucurbita, Lagenaria, Luffa* and *Momordica.*

4574 **(The cucumber variety VIR1).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 3 : p. 32. [Russian].

VIR1 [Institute of Plant Industry 1] was bred from Klinskij x Leningradskij Tepličnyj 23 [Leningrad Greenhouse 23]. It is a late-ripening hothouse type with a habit similar to that of Klinskij.

4575 Walker, J. C.
**Two new pickling cucumber varieties resistant to scab and mosaic.**
Plant Dis. Reptr. 1958 : **42** : 1337–38.

Wisconsin SMR 15 and Wisconsin SMR 18 have been produced by selections from crosses

between the material from which Wisconsin SMR 9 and 12 had previously been derived and Ohio MR 25 and Ohio MR 17 respectively. Both these varieties are homozygous for resistance to *Cladosporium cucumerinum* and highly resistant to cucumber mosaic virus. Fruit and vine characters of both varieties are described; they are superior in several ways to other resistant varieties.

4576 Nakamura, N. & Terabun, M.
**(Studies on artificial male sterility. III. On the mechanism of occurrence of artificial male sterility in the cucumber).**
Hyogo Noka Daigaku Kenkyu Hokoku : Nogaku Hen/Sci. Rep. Hyogo Univ. Agric. : Ser. Agric. 1956 : **2** : 169–73. [Japanese].

An increase of the proportion of female flowers to male was obtained by applying a 50 p.p.m. solution of the amine salt of 2,4-D. Ethylene chlorohydrin was ineffective in altering the floral sex ratio.

4577 Andeweg, J. M. & de Bruyn, J. W.
**Breeding of non-bitter cucumbers.**
Euphytica, Wageningen 1959 : **8** : 13–20.

Bitterness was assessed in 15,000 cucumber seedlings pertaining to numerous varieties. A number were free from bitterness but only one plant, from the American variety Improved Long Green, remained entirely nonbitter in both fruits and vegetative parts on reaching maturity. Both chemical and tasting tests were used. Crosses between this plant and a bitter Netherlands variety showed that the nonbitter character is recessive and monogenically determined. A similar type of inheritance of bitterness was found in melon. The chemical selection method used involves placing a drop of a chloroform extract of a cotyledon on a piece of filter paper which is then moistened with a saturated solution of $SbCl_3$ in chloroform. On heating, a fluorescent spot visible under a UV lamp appears if the bitter principle is present.

4578 Gilbert, J. C.
**Disease resistant cucumbers for Hawaii.**
Hawaii Fm. Sci. 1959 : **7** : No. 4 : 1–2.

An attempt is being made at the Hawaii Agricultural Experiment Station to combine resistance to *Erysiphe cichoracearum* and cucumber mosaic in a single variety. Since resistance to both diseases appears to be polygenic, this aim will not be easily achieved. A mosaic-resistant $F_1$ hybrid has been named Ilima Hybrid. Since the type of mosaic resistance exploited depended on a number of recessive genes, it was necessary to incorporate this entire gene complex into two distinct parental lines before the hybrid could be produced. Compared with other varieties, the hybrid has proved to be somewhat less susceptible to a highly virulent new strain of mosaic appearing in 1958.

4579 Alpatiev [Alpat'ev], A. V.
35 de ani de selecţie a tomatelor. (**35 years of tomato breeding**).
An. Romîno-Soviet. : Ser. Agric. 1956 : No. 2 : 93–100.

[Cf. XXVI, 1880].

4580 Holl, F.
**F.1 hybrid tomatoes.**
Tomato Cucumber Mark. Bd. J. 1959 : **8** : 123–25.

Comments are made on $F_1$ hybrids available for commercial growing in Great Britain.

4581 Åkesson, H.
Weibulls Immuna $F_1$-tomate. (**The Weibull $F_1$ tomato Immuna**).
Agri hort. genet., Landskrona 1959 : **17** : No. 1–2 : 76–95.

In extensive tests in Sweden, Norway and Denmark, Immuna [cf. XXV, 2482] was always among the most productive varieties and in addition was early, high in quality and, except in Denmark, free from *Cladosporium fulvum* [cf. XXVIII, 2361].

4582 Taran, L. D.
**(Interspecific hybridization of tomatoes with the pollen from the maternal flower being present).**
Dokl. Vsesojuzn. Akad. sel'skohozjajstv. Nauk Lenin. (Proc. All-Un. Lenin Acad. agric. Sci.) 1958 : No. 5 : 16–19. [Russian].

A method of interspecific hybridization developed at Odessa is recommended. It consists of fertilizing unemasculated plants of Humbert and Mikado by pollen of *Lycopersicon hirsutum* one or two days before the pollen on the mother plants ripens. Compared with the method in which the mother plant is emasculated, the plants set and develop more fruits and the number of seeds per fruit is increased. A larger number of plants was raised from the seed and the percentage of hybrids was high, 71·4% among the progeny of Humbert and 88·2% among that of Mikado. The $F_1$ plants resembled *L. hirsutum* but were more vigorous and flowered earlier. The $F_2$ comprised plants which on morphological characteristics were classified into four different groups. Only one of these

combined fertility with good horticultural characteristics. The $F_2$ in this group derived from Humbert differed from this cultivar by the size and shape of the fruits, which were round and treble the size. The $F_2$ hybrids of Mikado had dissected leaves instead of the entire potato-shaped leaves of Mikado. Some hybrids of Humbert x *L. hirsutum* and Mikado x *L. hirsutum* outyield the initial cultivars and have firm fruits with good keeping properties and could be put to immediate use in horticulture or used for crossing with other cultivars.

4583 Rick, C. M.
**The role of natural hybridization in the derivation of cultivated tomatoes of western South America.**
Econ. Bot. 1958 : **12** : 346–67.

The role of natural hybridization was studied by means of field observations and tests of the progenies raised from the seeds of fruits collected in the field and local markets. The progeny tests were carried out at Davis, Calif. The presence of the recessive character potato leaf (*c*) in about 5% of the plants in most of the fields visited in the Chile-Peru frontier region afforded the opportunity of estimating the rate of natural cross pollination by seedling tests. The frequencies of natural crossing in collections from two fields in southern Peru were respectively 25·7 and 14·8%. In a study of progenies each derived from a single fruit collected in various districts in Ecuador and Peru, 18 out of 34 collections showed segregation for monogenic characters and a considerable degree of variability in quantitative traits. The remaining progenies were in general much less variable in quantitative characters and may have been representative of varieties recently introduced from northern temperate countries. The variability observed in over half of the progenies probably resulted from hybridization, and partly from hybridization and subsequent introgression by *Lycopersicon pimpinellifolium*. The following characters are discussed, as providing evidence of a flow of genes from *L. pimpinellifolium* to *L. esculentum*. The genotype *HH*, characteristic of the wild species and responsible for the absence of large trichomes and the development of only small, simple and glandular hairs, was scarce or not found at all among cultivated tomatoes outside the geographical range of *L. pimpinellifolium*. When homozygous and when the environmental conditions are favourable for its expression, *cm* causes the "curly mottled" phenotype. First detected in PI196297 from Nicaragua some years ago, the gene occurs in most of the accessions of cultivated tomato from coastal Ecuador and in some collections of *L. pimpinellifolium* from the same region, but is absent from all other accessions of cultivated or wild tomatoes, with the exception of the above-mentioned Nicaragua introduction. The characteristic effect of *cm* is masked by the environmental conditions of the native region. The gene has been incorporated in most cultivated tomatoes of coastal Ecuador, presumably because it has some strong selective advantage. Accessions of cultivated tomatoes from this region were also characterized by an absence or great reduction of foliage odour. This feature appears to be a simple dominant and a consequence of a reduction in the size of the glandular hairs. Although the wild accessions from coastal Ecuador possess the typical odour of *L. pimpinellifolium*, it is still possible that loss of odour originated through hybridization between this species and the cultivated tomato, if odour were determined by different genes in the two species. In this connexion, it is mentioned that a few segregations entirely lacking odour have been obtained from *L. esculentum* x *L. peruvianum*. Collections from northern Peru provide more concrete evidence of introgression by the currant tomato, several accessions from two localities having the unmistakable odour of this species. Further evidence of such introgression is provided by observations on vegetative characters and variations in fruit size and shape. Some observations, on the other hand, are indicative of introgression of *L. pimpinellifolium* by *L. esculentum* in Peru. It is suggested that *L. pimpinellifolium* should be treated as a subspecies or variety of *L. esculentum* in view of the reciprocal introgression and the morphological gradation and chromosome homology between the two taxa. The author found no sign of introgression into *L. esculentum* by *L. hirsutum* f. *glabratum*, *L. peruvianum* or *L. chilense*. Archeological and ethnological information did not conflict with the view of Jenkins, who postulated that the ancestor of the cultivated tomato originated in the Peru-Ecuador region whence it spread to southern Mexico, where it underwent its first domestication and improvement [cf. XIX, 1386]. The rapid differentiation of the cultivated tomato into highly diverse races in western south America during the relatively short post-Columbian period might be explained by the following considerations: (1) the breeding system in this region, which permits not only a rapid exchange of genes by outcrossing but also

the establishment of homozygosity by self fertilization, (2) the necessity of producing a new generation each year from fresh seed because of the difficulty of seed storage under tropical conditions, and (3) the widespread practice among native farmers of saving their own seed.

4584 Ržavitin, V. N.
**(Utilizing black nightshade in vegetative hybridization of tomatoes).**
Učen. Zap. mordov. pedagog. Inst. (Sci. Notes Mordva ped. Inst.) 1956 : No. 3 : 114–59 : from Ref. Ž. (Ref. J.) 1958 : No. 7 : Abst. 28580. p. 31. [Russian].
The changes observed in a few tomato varieties, grafted on black nightshade, in the $F_0$, $F_1$ and $F_2$ are reported and five vegetative hybrids thus obtained are described.

4585 Tarnavschi, I. & Rădulescu, D.
Hibridarea vegetativă la plante. **(Vegetative hybridization in plants).**
An. Romîno-Soviet. : Ser. Agric. 1955 : No. 4 : 56–63.
After reviewing Soviet and Rumanian work on the above topic, the authors describe experiments in which pink fruits were obtained on the scions of $F_0$–$F_3$ vegetative tomato hybrids of the yellow-fruited variety Albino grafted on the pink-fruited variety Rosé.

4586 Georgieva, R.
**(The grafting of partially desiccated plants to obtain vegetative hybrids).**
Agrobiologija (Agrobiology) 1959 : No. 5 : 29–38. [Russian].
[Cf. XXVIII, 3493].

4587 **(The tomato variety Leningradskij Skorospelyj 2166).**
Sad i Ogorod (Gdn. & Veg. Gdn.) 1959 : No. 3 : p. 32. [Russian].
Leningradskij Skorospelyj 2166 [Leningrad Early 2166] was obtained by single-plant selection and directed training of a form originating from Latvia. It is an early indoor variety with fruits weighing 76–143 g. They have a high dry-matter content and their flavour and transportability are good.

4588 Nakagawa, S., Kamimura, S., Sato, I. & Hemmi, S.
**(Minori, a new tomato variety which requires no support).**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : 1241–42. [Japanese].
Minori [Harvest] was selected from the cross Pritchard x Bikuta. It needs no staking and is adapted to cool areas in the northern Japanese mainland. It has been registered as Norin 3 [Ministry of Agriculture and Forestry 3].

4589 **New canning tomato.**
Crops & Soils 1959 : **11** : No. 9 : p. 20.
At Purdue University, a new tomato named Stair has been developed; it is suitable for the canning of whole fruit, which is smooth and uniform in size.

4590 Georgberidze, A. I.
**(The prospects of utilizing vegetative hybridization in the development of tomato varieties).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 46–49. [Russian].
A number of hybrids obtained by vegetative or sexual hybridization or a combination of the two methods have outyielded Krupnoplodnyj 220 [Large-fruited 220] and other Georgian standard varieties at the Kutaisi Vegetable Breeding Station; they were also superior to the standards in the yield of first fruits, high-grade fruit and dry-matter content. The best hybrids were Mosavliani (Majak [Lighthouse] x Baltimore)/*Lycopersicon cerasiforme*, Imeruli (Break-o'-Day/*Solanum nigrum*), Kolhideli (Majak 12/20–4 x Bol'šie Krasnye 209 [Large Red 209]) and Sakonservo (Tamanec 172 [tomato from Taman' 172] x Baltimore).

4591 Yen, D. E.
**V–548—a new glasshouse tomato for release in 1959.**
NZ J. Agric. 1959 : **98** : 487–88.
V–548, an introduction from Canada, has been released in New Zealand, where it has shown immunity from *Cladosporium fulvum*. The selection, which is not to be released in Canada, derived its immunity from *Lycopersicon hirsutum*.

4592 Cannon, O. S. & Hanna, G. C.
**New disease resistant tomatoes.**
Calif. Agric. 1959 : **13** : No. 3 : p. 7.
Two new strains, Pearson VF6 and VF11, have been developed. Southland and Utah Experimental Hybrid Number 59–1 were crossed to obtain resistance to *Fusarium* and *Verticillium* wilts and the progeny were then crossed to Pearson for seven generations. The selections were made from the $F_2$ generation of the last Pearson back cross. These strains are similar to Pearson but are resistant to both wilts. A *Verticillium*-wilt resistant strain of Red Top,

Red Top V9, has also been developed by crossing Red Top with an early *Verticillium*-resistant plant of Red Top type. This new strain matures a few days earlier than Red Top.

4593 Simpson, W. R.
**30 years of research behind new Idaho tomato.**
Idaho agric. Sci. 1959 : **44** : No. 2 : p. 7.

The release of the curly-top resistant tomato Owyhee is reported. Of complex parentage, the variety derived its resistance from *Lycopersicon peruvianum.*

4594 Bazavluk, V. Ju.
**(Can polyploidy be used as a method of breeding solanaceous plants ?)**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 167–81. [Russian].

Many of the negative aspects of artificial polyploids are pointed out; even tetraploid rye, which is one of the most promising, is deficient in fertility and generally yields less than the diploid, and tetraploid buckwheat is still not widely grown in practice. It is further stated that polyploid sugar beet is not grown in England.

From grafts of the tomato Ficarazzi on *Solanum nigrum* some tetraploid plants ($2n = 48$) were produced; they were larger, reaching a height of 96 cm. as compared with 64·4 cm. for the diploids. Flowering and fruiting were later; Ficarazzi, being an early variety, bore most of its fruit between 17 and 24 August, the tetraploid between 31 August and 10 September; the tetraploid continued to bear over a longer season, at the end of which it had produced an average of 2·4 more fruits per plant but the total weight of fruits produced was only 700 g. compared with 1010 g. from the diploid, the fruits in the tetraploid being smaller. They were however 1·55% higher in dry-matter content and 2·12% higher in sugar content; their seed content was much lower.

Tetraploids of the variety Golden obtained in a similar manner were 10–12 days later in flowering and fruiting; they bore only 56 fruits per plant as compared with 136, the fruits being also smaller; the total yield of fruit was 299·4 g. in the tetraploids and 1515·9 g. in the diploids. Tetraploids of *S. nigrum* obtained in the same experiments were more vigorous than the diploids in the greenhouse but less so in the field. Their fruits were smaller, less uniform in maturity and contained less seeds.

The induction of polyploidy is not considered a suitable method of breeding solanaceous plants.

4595 Peirce, L. C.
**Heritability of certain economic characters in the tomato.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–7018 : p. 1178. (Abst.).

From a study of earliness, fruit size and yield in Manalucie x Earlinorth, the following conclusions were reached concerning heritability and selection. (1) Data on earliness and yield revealed additive gene action. Fruit size means were indicative of geometric distribution. (2) Heterosis occurred with respect to yield. Inheritance of earliness and fruit size showed little or no dominance. Estimates of heritability of fruit size, yield and earliness, based on variance components, were respectively 75, 39 and 38%. Heritability estimates representing regression of $F_3$ means on parental performance were respectively 68, 27 and 29%. The difference between the corresponding values is attributable to bias caused by genotypic-environmental interaction. (4) One generation of selection resulted in considerable gain in fruit size. A significant increase in yield was also obtained in the $F_3$, in spite of a tendency to select heterozygous $F_2$ plants. Date of ripening showed little response to selection; this appeared to be partly due to a relatively small amount of genetic variation. Environmental conditions limited the effectiveness of selection for yield and earliness. (5) Covariance analysis and progeny tests gave evidence of a consistently favourable genetic relationship between earliness and yield. Selection for fruit size, however, eliminated many desirable early and high-yielding genotypes. (6) The results suggested that early-generation selection might increase the value of $F_3$ material. "A program was proposed by which high yield potential might be retained in material superior in earliness and fruit size. This involved primary selection for yield on the basis of $F_3$ replicated tests followed by elimination of later maturing and small-fruited $F_3$ lines."

4596 Šmaraev, G. E.
**(The effect of growing conditions on the shedding of reproductive organs in tomatoes).**
Vestn. sel'skohozjajstv. Nauk. (Rep. agric. Sci.) 1958 : No. 8 : 133–38. [Russian].

The shedding of buds, flowers and ovaries by different varieties, grown at Puškin, Taškent and Kunja-Urgenč, was studied in relation to meteorological conditions and agronomic measures, tables showing varietal differences being

provided. The varieties most resistant to shedding had either a prostrate habit, as in Break o' Day 1638, or were sturdy compact bush types such as Majak 12/20–4 [Lighthouse 12/20–4] and Hybrid 6/1–1.

4597 Vasileva-Drjanovska, O. & Molhova, E.
**(A cytoembryological study of the pollination and fertilization of tomatoes by pollen of distantly related species).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 162–74. [Bulgarian].

The growth of the pollen tubes of *Lycopersicon esculentum, L. peruvianum, Cyphomandra betacea* and *Physalis peruvianum* down the style and in the embryo sac of the tomato was studied, interspecific differences in the rate of growth being noted. Only the pollen tubes of *L. esculentum* and *L. peruvianum* reached the embryo sac. The pollen tubes of *L. peruvianum* stimulated the development of the central nucleus but without fertilization. Observations on supplementary pollination of *L. esculentum* by the pollen of *L. esculentum* or *L. peruvianum* showed that more than one pollen tube sometimes reached the embryo sac before fertilization.

4598 Zaharova, G. M.
**(Inheritance of characters in $F_3$ tomato hybrids obtained from pollination with mixed pollen).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 164–66. [Russian].

The variety Želtyj Persik [Yellow Peach], with upright growth and round yellow fruits, when pollinated by Želtyj gruševidnyj [Yellow Pyriforme] + Mikado gave some plants combining the dissected leaves of the former pollen parent and the red fruits of the latter; in the $F_2$ of such a plant, one plant out of 20 combined characters of all three parents, bearing yellow fruits, some of which were round and flattened as in Mikado, some pear-shaped as in the Pyriforme parent and some round as in Želtyj Persik. An $F_3$ was produced from a yellow pear-shaped fruit. The 19 plants produced were of various types, some combining indeterminate habit with undissected leaves as in Mikado and yellow pear-shaped fruits as in Yellow Pyriforme.

4599 Young, P. A.
**Why tomato flowers fail to set fruits.**
J. Rio Grande Valley Hort. Soc. 1957 : **11** : 103–04.

The reasons for failure of fruit setting, in particular failure due to high temperature are discussed and types of tomato resistant to heat-induced sterility are mentioned.

4600 Augustín, V. & Čunderlíková, M.
Výber vhodných odrôd rajčiakov pre konzervárenský priemysel. **(The selection of suitable tomato varieties for the canning industry).**
Pol'nohospodárstvo 1958 : **5** : 486–503.

Requirements in a tomato suitable for the canning industry are considered and a system for evaluating canning quality is presented. This takes note of organoleptic characters such as external colour and form and smell, taste, colour and consistency of the pulp and physicochemical characters such as the proportion of sugar to acid and of sugar to refractometric dry matter, productivity and vitamin C content. About 50 varieties have been evaluated in this way. Varieties recommended for canning purposes included Sofijská konserva [Sofia Canning], Stupické pol'né rané [Stupice Field Early], Nízke producktívne [Short Productive], Ostravské rané [Ostrava Early] and Imun [Immune]. The quality of raw fruit required to produce one metric ton of pulp varied amongst the tested varieties from 3849 to 9297 kg. It is therefore suggested that breeders should consider not only the yield of fruit per ha. but also the yield of pulp. The content of dry matter greatly affects the yield of pulp.

4601 Stefanova, M., Bonev, M., Dučevska, H., Georgiev, D. & Jankov, S.
**(Studying fresh and stale tomatoes of several varieties and of concentrates obtained from them).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 69–80. [Bulgarian].

Concentrates made from tomatoes of Plovdivska Konserva [Plovdiv Canning], Zarja [Dawn] x Komet [Comet], 10 x Bison and Rutgers that had been kept for 2 to 4 days had lower sugar and vitamin C contents than those made from fresh fruits of the same varieties. Plovdivska Konserva showed the least reduction in sugar and vitamin content.

4602 Alexander, L. J.
**Progress Report of National Screening Committee for disease resistance in the tomato for 1954–1957.**
Plant Dis. Reptr. 1959 : **43** : 55–65.

Second and third series of accessions have been distributed for screening for resistance to 15 diseases by cooperators in the United States, Canada and Jersey. The most resistant varieties to the various pathogens are as follows:

*Alternaria solani*, *L. peruvianum* '128646', *L. pimpinellifolium* '205012', and suspected crosses *L. esculentum* x *L. pimpinellifolium* '204992', '205019', '190188', '195324', '204587' and '212411'; *Colletotrichum phomoides*, *L. esculentum* '92863', '128244', '171708', '92855' and '92859'; *Cladosporium fulvum*, *L. peruvianum* '126928' and '212407', and *L. pimpinellifolium* '211840'; *Didymella lycopersici*, *L. glandulosum* '126448', '199380'; *Fusarium oxysporum* f. *lycopersici*, race 1, *L. peruvianum* '126928' and '212407', *L. pimpinellifolium* '211838', 211839' and '212408', and suspected cross *L. esculentum* x *L. pimpinellifolium* '205033'; race 2, *L. peruvianum* '126928', '212407' and *L. pimpinellifolium* '211840', '212408' and '212409'; *Phoma destructiva*, *L. esculentum* '167041', '167074', '169566', '169567', '169571', '169575', '169580', '169581' and '169582'; *Phytophthora infestans*, tomato race 0, all accessions of *L. pimpinellifolium*, and all suspected crosess of *L. esculentum* x *L. pimpinellifolium* except '204975', '205022' and '205033'; tomato race 1, suspected crosses *L. esculentum* x *L. pimpinellifolium* '204996', '205016' and '205017'—of these the most promising source of resistance to both races is '204996'; potato virus Y, presumed *L. esculentum* '128887', and *L. esculentum* '117897'; *Meloidogyne* spp., *L. peruvianum* '212407'; *Septoria lycopersici*, intermediate resistance only shown by *L. pimpinellifolium* '205014', suspected crosses *L. esculentum* x *L. pimpinellifolium* '204987', '204999' and '126951', *L. peruvianum* '126928', '212407', and *L. esculentum* '128218', '129071', '111406' and '111407'; *Stemphylium solani*, *L. peruvianum* '216928', *L. pimpinellifolium* '211838', '211839', '211840', '212408' and '212409', suspected crosses *L. esculentum* x *L. pimpinellifolium* '205033', '190188' and '212410' and *L. esculentum* '106997'; tobacco etch, *L. esculentum* '166989' and presumed *L. esculentum* '183692'; and tobacco mosaic, *L. peruvianum* '126928' and '212407'. Testing for frost resistance was also carried out. No damage was observed in *L. esculentum* '97538', '99782' and '136475'.

4603 Krickl, M.
**Frostsichere Tomaten: Eine Aufgabe für die Zukunft. (Frost-resistant tomatoes : a problem for the future).**
Saatgutwirtschaft 1959 : **11** : 105–08.

Experiments conducted at the Schönbrunn Horticultural Experiment Station, Austria, with a view to improving the frost resistance of tomatoes are described; selection was carried out with material derived from an early line of Bonner Beste. The results indicate that it is possible to breed varieties capable of withstanding temperatures of −5 or −6° C. Since young plants are more susceptible than older ones, testing for cold resistance is best begun two months after germination.

4604 Jones, J. P.
**The relation of certain environmental factors, tobacco mosaic virus strains, and sugar concentration to the blotchy ripening disease of tomato and the inheritance of the tendency to the disease.**
Diss. Abstr. 1958 : **19** : LC Card Mic 58–3432 : 650–51. (Abstr.).

Varietal trials revealed considerable differences in susceptibility and resistance to blotchy ripening. Ponderosa was probably the source of the resistance shown by several pink-fruited varieties. The incidence and severity of the disease were much lower in hybrids between Strain A Globe and susceptible varieties than in the latter parents. By subjecting plants to such conditions as high N supply, shade and high soil moisture, which caused the development of succulent plants, the disease could be developed consistently at will. Since the development of the disease under controlled conditions is now possible, breeding for resistance, utilizing Strain A Globe, may be initiated. Evidence concerning the possible association of the disease with a carbohydrate deficiency was conflicting.

4605 Crozier, J. A. (Jun.) & Boothroyd C. W.
**Tomato a new suscept of *Gibberella zeae* (Schw.) Petch.**
Plant Dis. Reptr. 1959 : **43** : 446–47.

*G. zeae* is recorded for the first time on tomato, being found on greenhouse-grown fruits of the variety Marglobe, which has a high proportion of shoulder cracking of fruits. Varieties resistant to shoulder cracking grown adjacent, namely Boston Comet, Comet, Trellis 22 and Crack-resistant Trellis, showed no sign of infection.

4606 Henning, R. G. & Alexander, L. J.
**Evidence of existence of physiologic races of *Alternaria solani*.**
Plant Dis. Reptr. 1959 : **43** : 298–308.

Preliminary evidence is presented for the existence of seven physiological races of *A. solani* in Ohio, distinguished on the basis of qualitative differences in pathogenicity to the tomato. Some discrepancies in correlation of the results

of the experiments suggest that cryptic changes in pathogenicity occur in cultures of the fungus.

4607 **Merbein tomato hybrids.**
Rur. Res. CSIRO 1959 : No. 27 : 6–9.
Tomato breeding for resistance to *Fusarium* wilt and nematodes (*Meloidogyne* spp.) in Australia is reviewed. Breeding at the Commonwealth Research Station, Merbein, has resulted in the following three *Fusarium*-wilt and nematode resistant varieties, which have been released for testing under a wider range of conditions. Merbein Early (Bounty x HES4242) is a very early type suitable for large-scale cultivation without pruning and staking. The fruit is globular and fairly resistant to sun scald. The plants are resistant to wilt under most conditions and 90% of them are highly resistant to nematode attack. Merbein Mid-season, involving Bounty, South Australian Dwarf and HES4242 in its parentage, may be grown as a bush or staked and pruned. Field immune from *Fusarium* wilt, 62% of the plants are highly resistant to nematodes, the remainder being sufficiently resistant to produce a crop. A very early variety, Merbein Canner, has Rouge de Marmande, Pan America, Tatura Dwarf Globe and HES4242 in its pedigree. Its fruits are globular, medium sized and high in canning quality. All three varieties are eelworm resistant. They have been released at a stage short of complete uniformity to allow for further selection in particular environments.

4608 Hagiwara, T. & Takeda, M.
**(Is this not an instance of parthenogenesis in the egg plant ?)**
Nogyo oyobi Engei/Agric. & Hort. 1957 : **32** : p. 376. [Japanese].
Purple fruit colour is dominant to yellow. In a cross between a purple and a yellow-fruited variety, pollinated by the purple-fruited form, 4 yellow-fruited plants, 1 orange-fruited plant and 58 purple-fruited plants were obtained. It is thought that the yellow-fruited plants may have arisen from diploidization of an egg carrying the recessive gene for fruit pigmentation.

4609 Popova, D.
**(The duration of pollen viability and stigma receptivity in the egg plant).**
Izv. Inst. Rasten. (News Inst. Pl.-Industr.), Sofija 1958 : **6** : 125–34. [Bulgarian].
The pollen of Delikates [Delicacy] and Israel, used for pollinating variety 12 and line 43 respectively, remained viable for 8–10 days when kept in 60–65% humidity at a temperature of 20–22° C. Less seed was set and the average weight of fruit was reduced when the pollen was kept longer than 6 days. The stigmas of 12 and line 43 were receptive to pollen for 7 days after emasculation, though the seed sets, average fruit weight and average number of seeds per fruit were lower from the fourth day after emasculation.

4610 Roy, R. P. & Jha, R. P.
**A semi-asynaptic plant of *Abelmoschus esculentus* (L.) Moench. (= *Hibiscus esculentus* L.).**
Cytologia, Tokyo 1958 : **23** : 356–61.
A plant studied at the Department of Botany, Patna University, India, had luxuriant vegetative growth, a large number of flowers and leaves and much longer duration of growth than normal plants. The fruits were smaller than normal and, except in a few cases, completely empty. The few apparently normal seeds produced were without embryos. Complete or partial failure of chromosome pairing was observed in PMC meiosis, the univalents usually dividing at anaphase I. Some apparently normal pollen grains were however found which produced small tubes when placed on the stigma. The pollen grains could therefore to some extent survive the loss of some genes or even chromosomes, possibly on account of the polyploid nature of the species. The results of pollinating the abnormal plant by adjacent normal individuals showed that no functional eggs were formed, presumably also as a consequence of asynapsis. The formation of normal fruits is attributed to the stimulus received from growth of the pollen tubes from the apparently normal grains.

4611 Nariani, T. K. & Seth, M. L.
**Reaction of *Abelmoschus* and *Hibiscus* species to 'yellow vein' mosaic virus.**
Indian Phytopath. 1958 : **11** : 137–43.
In investigations undertaken at the Indian Agricultural Research Institute, New Delhi, to find sources of yellow-vein mosaic resistance for okra breeding, *H. manihot* var. *pungens*, *H. crinitus*, *H. vitifolius* and *H. panduraeformis* were found to be immune.

4612 Dharampal Singh
**Bibliography of research work done in India on major pulse crops—principally on genetics, breeding and diseases.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 84–89.
The bibliography gives references dealing with

the following crops: *Cajanus cajan, Phaseolus aureus, Ph. mungo, Ph. aconitifolius, Glycine max, Lens esculenta, Vigna sinensis, Lathyrus sativa* and *Cicer arietinum.*

4613 Singh, S. P.
**Improved varieties of pulse crops in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 58–60.

Information is given on improved varieties of *Cajanus cajan, Phaseolus mungo, Ph. aureus, Vigna sinensis, Glycine max, Cicer arietinum, Pisum sativum* and *Lens esculenta.*

4614 Klingsmüller, W.
Zur Möglichkeit eines nachträglichen Strahlenschutzes bei Samen von *Vicia faba.* **(On the possibility of post-irradiation protection in seeds of *V. faba*).**
Z. Naturf. 1959 : **14b** : 268–72.

X-ray damage, measured as the effects upon germination rate, growth of root and shoot, rate of mitosis and distribution of mitotic phases in the root tip, was greater in seeds stored at low relative humidity than in those stored at high. Cysteine, cysteine-HCl and cysteamine were all without protective effect on dry-stored seeds when applied after irradiation.

4615 Moutschen-Dahmen, M., Moutschen, J., & Ehrenberg, L.
**Chromosome disturbances and mutation produced in plant seeds by oxygen at high pressures.**
Hereditas, Lund 1959 : **45** : 230–44.

When oxygen was applied at 30–60 atmospheres to seeds of *Vicia faba* for 3–28 days, high frequencies of fragments and anaphase bridges were found; the frequency of the breaks increased with the duration of treatment. Nitrogen at 60 atmospheres induced aberrations at a very low but measurable rate. The highest aberration rate was found in the second mitosis after the onset of germination; the rate then dropped, micronuclei and fragments being rapidly eliminated. Breakage points were distributed at random within the genome.

Barley seeds were also treated with oxygen under high pressure and the chlorophyll-deficient seedlings occurring in the second generation after treatment were observed. Most of the mutants found were of the *albina* type.

From these results it appears that the mutagenic mechanism of oxygen is related to that of ionizing radiations.

4616 Rieger, R. & Michaelis, A.
Vergleichende Untersuchungen zur Verteilung durch verschiedene Mutagene induzierter Brüche über den Chromosomensatz von *Vicia faba* L. **(Comparative investigations on the distribution of breaks induced by different mutagenic substances over the chromosome set of *V. faba* L.).**
Chromosoma 1959 : **10** : 163–78.

It was found that breaks induced by X rays were distributed at random over the large SAT chromosome of *V. faba.* The distribution was almost random over the m chromosomes, there being statistically significant minima at the ends and small maxima in the middle of the long arms.

Breaks induced by an automutagenic substance produced during anaerobiosis were most frequent in regions on both sides of the centromere in the SAT chromosome and in the central regions of the long arms of the m chromosomes; these maxima were statistically significant.

Considering the length of the chromosomes, the expected distribution of breaks between SAT and m chromosomes is in the ratio of 2 : 5; the proportions found for X-ray induced breaks were however 1·2 : 5·0 and 1·44 : 5·0. It is therefore suggested that the SAT and m chromosomes differ in structure and so react differently to cellular constituents modified by X irradiation. Chromatid translocations induced by the automutagenic substances were also more frequent in some regions of the chromosomes than in others. [Cf. 2049].

4617 Ueki, K.
**(Intervarietal differences in the reaction of flowering and fruiting in the broad bean to nocturnal temperature treatment. III. The influence of high nocturnal temperature on growth and fruit setting).**
Kagawa Daigaku Nogyobu Gakujutsu Hokoku/Tech. Bull. Fac. Agric. Kagawa Univ. 1957 : **9** : No. 1 : 1–10. [Japanese].

In one experiment, the effects of high nocturnal temperature before flowering on stem length, number of branches, number of leaves, leaf area, flowering date, number of flowers, location of first flowering node and dry weight for three varieties differing in maturation period were studied. It was noted in particular that numbers of branches and flowers increased after treatment in some varieties and decreased in

others. In a second experiment, the effects of high nocturnal temperature on duration of fruiting, pod set, and weight, number and size of seeds for three late varieties differing in duration of fruiting periods were investigated. It was found that the treatment markedly curtailed duration of fruiting, the reduction being positively correlated with duration of fruiting in the controls [cf. 3244].

4618 Landbouwstambonen, 1959. (**Agricultural French beans, 1959**).
Landbouwvoorlichting **16** : Bijl. 46; Ber. Rassenkeuze 1959 : No. 263 : Pp. 4.
Relative yields of 17 varieties tested in the Netherlands are given. Among the six new varieties included in the trials, promise has been shown by CB53–211, which yields well and resists diseases, v.d. Have 5, which is very early, and Koekoek, which is very good in quality.

4619 Buishand, T.
Rassenonderzoek bij bonen. (**Varietal trials of beans**).
Med. Proefsta. Groenteteelt volle Grond 1959 : No. 11 : Pp. 71.
The results of 150 trials of dwarf beans, climbing French beans and runner beans, laid out in the Netherlands and the province of Antwerp in 1957 and 1958, are reported. Data on yield, earliness, quality, commercial value and incidence of disease are included. Among the dwarf beans, the recent variety Prelude proved early, productive, high in quality and resistant to virus diseases, but susceptible to *Sclerotinia*, *Botrytis* and anthracnose. Of the two new stringless climbing French beans for slicing, Precosa and Helda, the former has shown promise in respect of earliness and yield.

4620 Sahai, J. M.
**Improvement in urd (*Phaseolus mungo* Linn.) in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 54–55.
A review is given of improvement of *Ph. mungo* by selection and hybridization.

4621 Mehta, T. R. & Sahai, J. M.
**A review of breeding work on mung (*Phaseolus aureus* Roxb.) in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 56–57.
The results of early and more recent work on the improvement of *Ph. aureus* by selection and hybridization are summarized.

4622 Kloz, J.
Vliv roubování na proměnlivost rostlin ("vegetativní hybridisace"). [**The influence of grafting on variability of plants ("vegetative hybridization")**].
Čsl. Biol. 1957 : **6** : 401–15.
In grafting experiments using the kidney bean Saxa as stock and the soya bean Italian Piave as scion, the urease in seeds of the scion was qualitatively unchanged. Also when either variety was used as scion, there were no changes in the reserve proteins of the seeds, glycinin or phaseolin. Various tomato varieties were grafted on to other members of the Solanaceae; morphological studies of progenies of the tomatoes did not reveal any transfer of characters from stock to scion. Descendants of the tomato Imun [Immune] grafted on to *Lycium halmifolium* showed changes in fruit colour and floral morphology; these changes appeared to be hereditary and were not the result of virus infection.

4623 Hahn, P.
Durch richtige Sortenwahl—Steigerung der Marktproduktion bei der Buschbohne. (**Increasing market production in the dwarf bean by the right choice of varieties**).
Dtsch. Gartenbau 1959 : **6** : 96–98.
The results are reported of trials of dwarf-bean varieties held at four centres in the German Democratic Republic during 1954–58. Of the varieties with green pods, the highest yields were obtained from Selecta, Prinsa, Granda II and Nobila; the highest-yielding yellow varieties were Sonnengold [Sun Gold], Goldmarie and Wachs Quitlinga [Wax Quitlinga]. The varieties differed in their reactions to the environmental conditions of the different centres. None of the varieties showed complete resistance to *Colletotrichum lindemuthianum* but Granda II, Prinsa, Imuna, Stella, Sonnengold and Wachs Resista [Wax Resista] were highly resistant.
Descriptive notes are provided on eight recommended varieties.

4624 Rabanová, L.
Výskyt a príčiny alogamie u *Phaseolus vulgaris* L. (**Occurrence and causes of allogamy in *Ph. vulgaris***).
Biológia, Bratislava 1958 : **13** : 180–89.
Among 14 varieties of *Ph. vulgaris*, the percentage of natural cross pollination varied between 0 and 2·97. Environmental conditions had

marked effects on the frequency of natural hybridization. It is suggested that insects of the order Thysanoptera play some part in the transfer of pollen.

4625 Gabryl, J.
Obserwacje nad stopniem porażenia przez choroby niektórych odmian fasoli (*Phaseolus vulgaris*), przeprowadzone w Puławach w latach 1953–1955. [**Observations on the degree of infection by diseases in some varieties of French bean (*Ph. vulgaris*), carried out in Puławy in the years 1953–55**].
Hodowla Roślin Aklimatyz. Nasiennictwo 1958 : **2** : 261–83.

Of 57 varieties tested, all became infected with anthracnose. The snap-bean varieties Holenderska Księżniczka [Dutch Princess], Lange Brech [Long Snap], Prinsa and Wax Triumph, a Bulgarian strain of the snap bean Saxa and the dry-bean varieties Abondance de Saint Michelet, Allerfrüheste Weisse [White Earliest of All], Arla, Michigan, Norida and Immuna showed 1% infection or less with bacterial blight. The snap bean Logan and the dry beans Michigan and Norida were resistant to infection with *Phaseolus* viruses 1 and 2.

4626 Panzer, J. D. & Nickeson, R. L.
**Delayed synergism of bacterial blight and bean mosaic on *Phaseolus vulgaris* L.**
Plant Dis. Reptr. 1959 : **43** : 133–36.

No commercial varieties were found to be resistant either to common blight (*Xanthomonas phaseoli*) or bean mosaic virus whether present alone or in combination. Foreign (PI) accessions also tested showed several resistant to each pathogen and the following resistant to both in combination: 177501, 179008, 181953, 176681 and 207203.

4627 Snyder, W. C., Nash, S. M. & Trujillo, E. E.
**Multiple clonal types of *Fusarium solani phaseoli* in field soil.**
Phytopathology 1959 : **49** : 310–12.

The soil population of the field sampled was composed of at least twenty-one distinctive pathogenic clones of *F. solani* f. *phaseoli*, as measured by differences in growth, appearance in pure culture and virulence. Thus *Fusarium* root rot of a single bean plant in the field may result from multiple clonal infections of the fungus.

4628 Ramírez Genel, M., Casas, E. & Rubio del Cueto, A.
Susceptibilidad de algunas variedades de frijol al picudo del ejote en la Mesa Central. (**Susceptibility of some varieties of French bean to *Apion godmani* in the Mesa Central**).
Agric. téc. Méx. 1958–59 : No. 7 : 6, 37–38.

In tests of 14 varieties, incidence of larvae and adults of *A. godmani* was lowest and yields highest in Negro 151 [Black 151], Pinto 168, Pinto 162 and Amarillo 154 [Yellow 154]. The three new varieties Canocel, Negro Mecentral [Mecentral Black] and Bayomex [cf. XXVIII, 2671] were susceptible.

4629 Baggett, J. R. & Frazier, W. A.
**Disease resistance in the runner bean, *Phaseolus coccineus* L.**
Plant Dis. Reptr. 1959 : **43** : 137–43.

The following accessions were tested for disease resistance at Oregon State College: 2012, 2014, 2016, 2018, 2019, 20208. Inoculations with a wide range of viruses, including bean yellow mosaic virus, western ring spot, lucerne mosaic, bean common mosaic, pod blotch, node necrosis and mottle virus showed that accessions 2014, 2019 and 2020 were resistant to all, with the exception of some strains of lucerne mosaic to which 2019 only was resistant. When inoculated with *Pseudomonas phaseolicola*, all six lines developed primary necrotic lesions, but few halos, and all appeared resistant to *Uromyces phaseoli* var. *typica*. Resistance to *Fusarium solani* f. *phaseoli* is greater in the field than under greenhouse conditions. It was highest in 2014 and a selection from 2020, designated SR–1.

Productive hybrids with *Ph. vulgaris* have been obtained and 2014 x Blue Lake, after the first back cross to Blue Lake, promises to yield commercial types resistant to many virus strains.

4630 Dean, L. L., Wilson, V. E., Thornton, R. E. & Agenbroad, O.
**Unusual reactions of two snap bean varieties to two strains of common bean-mosaic virus.**
Plant Dis. Reptr. 1959 : **43** : 131–32.

Snap-bean varieties which differ in their reaction to type and variant strains of the above virus have been found at the Idaho Agricultural Experiment Station. Puregold is resistant to the type strain but susceptible to the variant, while the converse holds for Improved Tendergreen.

4631 Wester, R. E. & Cetas, R. C.
**Breeding lima beans for resistance to downy mildew.**
Plant Dis. Reptr. 1959 : Suppl. 257 : 181–82.

A highly resistant variety, Thaxter, was developed from crosses between Early Thorogreen and Fordhook 242 with resistant foreign introductions, and proved very productive and well adapted for vining. Since 1958, however, it has proved susceptible to race 3 of *Phytophthora phaseoli*. Resistance to this race has been found in Piloy, PI189403 from Guatemala, which is also resistant to race A. This has been crossed with Thaxter, Fordhook 242 and USDA 551. It is hoped that Piloy will contribute other genes for improvement of Lima beans as well as resistance.

4632 Webster, R. E. & Jorgensen, H.
**A new race of *Phytophthora phaseoli* from lima beans.**
Plant Dis. Reptr. 1959 : **43** : 184–86.

Since the discovery of *Ph. phaseoli* in 1889 no new races have been found until 1958, when a new race, B, was isolated from pods of Lima bean US355 in New Jersey. This has since proved pathogenic to several lines known to be resistant to the original race A. Work is in progress to locate resistance to race B.

4633 Sitterly, W. R. & Epps, W. M.
**Lima bean scab found in South Carolina.**
Plant Dis. Reptr. 1958 : **42** : p. 1309.

The incidence of *Elsinoe phaseoli* on Lima beans in South Carolina is reported. Numerous lesions were found on pods of the varieties Concentrated Fordhook and Fordhook 242; stem and leaf lesions were observed on these and also on Baby Green Fordhook, Clark's Bush, Nemagreen and Thaxton.

4634 Hare, W. W.
**Resistance to root-knot nematodes in cowpea.**
Phytopathology 1959 : **49** : p. 318. (Abst.).

The cowpea Iron and four breeding lines, M255, M455, M755 and M855, were resistant to *Meloidogyne incognita, M. incognita* var. *acrita, M. javanica* and *M. arenaria* when tested as young plants in the greenhouse. Several varieties, including Arlington, Brown Sugar Crowder and Dixilee, were susceptible. No galls were found on the resistant varieties after inoculation with *M. arenaria* but small galls were produced by the other three nematodes. Eighty $F_3$ progenies of M455 x Brown Sugar Crowder and the parental varieties were inoculated with *M. incognita*. Eighteen progenies were resistant, 38 segregated and 24 were susceptible. In the segregating progenies the ratio was approximately 2·3 resistant to 1 susceptible. These results suggest that resistance to *M. incognita* is controlled by a single gene pair with resistance dominant to susceptibility.

4635 deZeeuw, D. J. & Ballard, J. C.
**Inheritance in cowpea of resistance to tobacco ringspot virus.**
Phytopathology 1959 : **49** : 332–34.

Of a number of Black cowpea plants inoculated with isolates of tobacco ringspot virus, a quarter of the seedlings were susceptible and the remaining plants displayed varying numbers of small chocolate-brown lesions and almost no systemic involvement. Appropriate crosses were made to determine the genetic basis of the resistant reaction. An observed ratio of 309 resistant to 134 susceptible plants in the $F_2$ was obtained, suggesting a single gene dominant for resistance. Reliable differentiation could not be made between heterozygous and homozygous plants. The resistance in the material used apparently originated from a single heterozygous individual of unknown origin. The resistant reaction is an expression of hypersensitivity rather than immunity and the susceptible reaction is expressed by large local lesions, systemic invasion, top necrosis and death of the plant.

4636 Puerto Romero, J. & Alonso y Martín de Eugenio, A.
Experiencias con variedades de soja 1956. (**Trials of varieties of soya bean 1956**).
An. Inst. nac. Invest. agron., Madr. 1958 : **3** : 541–607.

Puerta Romero, J. & Alonso y Martín de Eugenio, A.
Experiencias con variedades de soja 1957. (**Trials of varieties of soya bean, 1957**).
Ibid. 1958 : **3** : 611–709.

Details are given of the results of trials of 12 varieties with a short vegetative cycle, tested in different areas in Spain in 1956 and 1957, and of three long-cycle varieties tested in 1956 only. Data on the oil and protein contents of the 12 short-cycle varieties in 1956 are included. Harosoy, described as belonging to maturity group II, gave the highest average yield for the two years, followed by Clarke and

Hawkeye, belonging to groups III and II respectively. These three were also highest in yield of protein and oil. On the basis of the results obtained, recommendations for cultivation in different localities are made.

4637 Martínez Salazar, E.
La soya, nuevo cultivo para el noroeste. **(The soya bean, a new crop for the north west).**
Agric. téc. Méx. 1958–59 : No. 7 : 23, 35.
In tests conducted in the Yaqui valley, Mexico, in 1957, Lee was the highest in yield of eight varieties.

4638 **Newly licensed varieties.**
Seed Scoop 1959 : **5** : No. 5 : 5, 8.
The soya bean Merit (Blackhawk x Capital) is particularly well adapted in south-western Quebec and certain areas of Ontario. Maturing in 117–118 days from sowing at Ottawa, it is 5–6 days earlier than Capital. It has a higher oil content than other varieties in the same maturity range.

4639 Zolotnickij, V.
**(Soya bean).**
Nauk. pered. Opyt sel'sk. Hozjajstv. (Sci. progr. Exp. Agric.) 1958 : No. 9 : 59–61. [Russian].
The new varieties Pobeda [Victory], Habarovsk 5, 6, 9 and 25 and Amur 42 were bred at the Far Eastern Agricultural Institute or the Amur Research Station. They are highly productive and ripen early, even in long days. Podeba has outyielded all other varieties in recent trials in the province of Amur. It is also interesting for its large seeds, high oil and protein contents and resistance to shedding.

4640 Staten, R. D. & Hodges, R. J.
**Soybean production in Texas.**
Bull. Tenn. agric. Exp. Sta. 1958 : No. 919 : Pp. 14.
The origin, colour characteristics, number of seeds per pod and per pound, protein %, oil % and average yield of different varieties are given for the period 1943 to 1954. Two of the varieties were released recently. D53–526, from D632–15 x D49–2525, is superior in yield and shattering resistance to other varieties in the same maturity group. Hood, from Roanoke x N45–745, is comparable to Lee in most respects and matures about one week earlier. Lee, Ogden and Dorman are recommended for the northern part of the state and Jackson and Improved Pelican for the south.

4641 Šimanskij, N. K.
**(Intervarietal crossing of soya bean without emasculating the flowers).**
Agrobiologija (Agrobiology) 1958 : No. 5 : 129–32. [Russian].
A method of breeding by which uniform true-breeding progenies morphologically indistinguishable from the ♀ parent, but superior to it in economic characteristics such as yield, oil or protein content of the seed or earliness, has been developed at Odessa. It consists of fertilizing unopened unemasculated flowers of one variety by the pollen of another or a pollen mixture of other varieties. Mention is also made of the cross Staroukrainskaja [Old Ukrainian] x Harbin 111 + VSGI80 [Breeding-Genetics Institute 80] + VSGI42 which, by way of exception, gave a progeny resembling the pollen parent.

4642 Vörös, J., & Molnár, B.
*Peronospora manshurica* (Naumoff) Sydow, a szója új kórokozója Magyarországon. [***P. manshurica* (Naumoff) Sydow, a soya-bean disease new to Hungary**].
Növénytermelés 1958 : **7** : 371–74.
Early varieties generally seem to be more susceptible than late to the above disease, the most resistant of the commonly grown Hungarian varieties being Szürke barát [Grey Friar] and Gigant [Giant].

4643 Smith, P. E. & Schmitthenner, A. F.
**Further investigations of the inheritance of resistance to *Phytophthora* rot in the soybean.**
Agron. J. 1959 : **51** : 321–23.
Two crosses, each involving one resistant and one susceptible parent, were used, namely Illini x Hawkeye and Blackhawk x Capital. The combined results of the $F_2$, $F_3$ and $F_4$ generations of these crosses indicate that resistance to *Ph. sojae* is dominant and conditioned by a single gene pair [XXVIII, 1043]. The excess of susceptible plants in the $F_3$ and $F_4$ progenies of the Blackhawk x Capital cross suggests that the dominant allele for resistance is modified by other genes which tend to inhibit the full expression of resistance.

4644 Hartwig, E. E.
**Effect of target spot on yield of soybeans.**
Plant Dis. Reptr. 1959 : **43** : 504–05.
Three resistant and three susceptible lines derived from the cross Roanoke x (Ogden x CNS) were tested in two successive seasons in

which incidence of *Corynespora cassiicola* differed. Differences in seed yield were found to be significant only when there was moderately heavy development of the disease on susceptible lines.

Further experiments were conducted with three resistant selections, Jackson, Lee and D49–2491, and yields on clay and sandy soils were found to be similar, whereas susceptible lines were much more heavily infected on light soils.

4645 Ross, J. P.
**Influence of resistance to *Heterodera glycines* on soybean yield and nematode populations.**
Phytopathology 1959 : **49** : p. 319. (Abst.).

*H. glycines* does not reproduce on the roots of the variety Peking. Respective yields of susceptible and resistant plants growing in unfumigated plots were 37 and 66% of the yields of the same lines growing in fumigated plots. After maturity the average nematode population in unfumigated plots was 3 (range 0–10) larvae per pint of soil for Peking and 320 (range 20–1100) for the susceptible line.

4646 Schmalz, H.
Der Einfluss alternierender Kurztag- und Dauertag-Perioden verschiedener Länge auf die generative Entwicklung der Sojabohne und *Kalanchoë blossfeldiana.* **(The influence of alternating short day and continuous day periods of different length on the generative development of the soya bean and *K. blossfeldiana*).**
Naturwissenschaften 1959 : **46** : p. 212.

As with the long-day plant, spring wheat [cf. XXVIII, 2770], the development of these short-day plants was accomplished more quickly when the alternating short and continuous day periods were of 7 days duration than when they lasted three days or one day. It is supposed that when the alternating periods are of short duration, less flowering hormone can be produced.

4647 Lu, Y.-C.
**(Studies on the photoperiodic treatment of soya beans).**
Nung-lin-hsueh Pao/J. Agric. For., Taichung 1957 : **6** : 1–16. [Chinese].

Eight varieties were grown under 9, 10, 11, 12, 13, 14 and 24 hr. photoperiods in the autumn of 1955 and summer of 1956. All varieties proved sensitive to short days in the autumn but in the summer the only varieties sensitive to short days were Pen-tung-ching-pi [Pentung Green] and Tai-wan-wu [Taiwan Black].

4648 Mehta, T. R.
**A review of research work on peas in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 32–34.

A short historical survey is given of improvement of *Pisum sativum* in Uttar Pradesh by means of testing introductions, selection and hybridization.

4649 Garatuza, M. & Casseres, E. H.
Experimentos con el chícharo en el Valle del Yaqui. **(Experiments with peas in the Yaqui valley).**
Agric. téc. Méx. 1958–59 : No. 7 : 7, 34.

Data on yields of fresh pods and dried seeds and on days to maturity are given for eight varieties tested in the season 1957–58.

4650 Lamprecht, H.
Die Vererbung der Farben von *a*-Samen von *Pisum.* **(The inheritance of colours of *a* seeds of *Pisum*).**
Agri hort. genet., Landskrona 1959 : **17** : 1–8.

The gene *A* governs the presence and gene *a* the absence of anthocyanins, but seed colour may also be affected by other genes. The different colours of seed, testa and cotyledons found in *a* seeds are described and the following genotypes noted: *aIO* and *aIo*, seed flesh-coloured, testa colourless; *aiO*, seed iris-green, testa ice-green; and *aio*, seed cream-coloured, testa colourless. A cross between a plant with iris-green seeds and one with greenish-blue seeds indicated the occurrence of a further gene pair, *Gla gla* (from *glaucescens*), the two parents having the following genotypes and colour combinations: *aiOGla*, iris-green seeds and ice-green testa; and *aiOgla*, greenish-blue seeds and colourless testa. A slight effect of *Gla* upon the cotyledons was also observed, those with *Gla* being slightly bluer than those with *gla*.

4651 Lamprecht, H.
Ein Gen für ockergelbe Färbung der Testa und seine Lage im Chromosom III von *Pisum.* **(A gene for yellow-ochre coloration of the testa and its position on chromosome III of *Pisum*).**
Agri hort. genet., Landskrona 1959 : **17** : 9–14.

The previously described independent genes *gl* and *cor* determine the presence of a localized yellow-ochre coloration above the radicle and around the hilum respectively. A new recessive gene, *och*, nonallelic with the other two and causing yellow-ochre pigmentation of the entire

testa, has been identified. Linkage studies show that it lies on chromosome III, for which the probable gene sequence is given as *Uni-M-Rf-Mp-Lob-F-Pu-Cry-St-Fov-Och-L-B-Gl.* Crossing-over values for *N-Tra-Le-V* on chromosome IV, obtained during the course of the above work, are also noted.

4652 LAMPRECHT, H.
Das Merkmal *insecatus* von *Pisum* und seine Vererbung sowie einige Koppelungsstudien. (**The character *insecatus* of *Pisum* and its inheritance and some linkage studies**).
Agri hort. genet., Landskrona 1959 : **17** : 26–36.

The *insecatus* character, in which the leaflets, usually only the basal ones, are distinctly notched at the tip, is recessive and determined by a single gene designated *ins.* A cross involving *ins* and 15 other genes confirmed the previous linkages *D-O-I,* on chromosome I, *M-B-Gl* on chromosome III, *Gp-Te-Fs-Ust* on chromosome V and *R-Bt* on chromosome VII but failed to reveal any definite linkage for *ins;* it may be on chromosome I, for which the cross-over values show very weak linkage because of an interchange between I and VII in one of the parents [cf. XXVI, 2952]. Correlations between segregation for fertility and semisterility on the one hand and segregation of the genes *R* and *Bt* on chromosome VII and of *I* on chromosome I on the other were detected; the other genes on chromosome I showed less definite correlations.

4653 LAMPRECHT, H.
Über Wirkung und Koppelung des Gens *Alt* von *Pisum.* (**On the effect and linkage of the gene *Alt* of *Pisum***).
Agri hort. genet., Landskrona 1959 : **17** : 15–25.

Studies of two crosses involving the above gene [cf. XXVI, 2949] and 25 other genes distributed among all seven chromosomes indicated that *Alt* lies on chromosome III, probably in the position *M-Rf-For-Alt-St-B-Gl.* Confirmation was obtained of the linkage *A–D* in chromosome I, *Vim-Le* in chromosome IV and *R–Tl* in chromosome VII.

4654 Das Gemüseerbsensortiment. (**The vegetable pea collection**).
Saatgutwirtschaft 1959 : **11** : Nos. 5–6; Samenfachmann 1959 : No. 14 : 105–12; No. 15 : p. 120.

Brief descriptions are provided of 17 shelling peas, 33 marrowfat peas and seven sugar peas.

4655 **Seed bulletin. Peas and fieldbeans.**
IVRO, Wageningen 1957 : Pp. 12.
**Supplementary seed bulletin. Peas and fieldbeans.**
Ibid. 1958 : Pp. 3.

Varieties of blue, yellow and marrowfat peas and field beans recommended for the Netherlands are briefly described.

4656 **Seed bulletin. Peas and beans.**
IVRO, Wageningen 1959 : Pp. 12.

Yield data and descriptive notes are given for varieties of blue peas, marrowfats and field beans (*Vicia faba*) grown in the Netherlands. The new blue peas Rovar, a high-yielding variety with large, light-green seeds of good quality, resistant to yellowing and *Fusarium* wilt, and Fertila, which yields well, has fairly small seeds and is suitable for canning, are included. The former is derived from Rondo CB x Vares repeatedly back crossed to Rondo CB and the latter from Servo x Stijfstro [Stiff Straw].

4657 MEHTA, T. R.
**Pea type 163.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 35–37.

Developed from a local sample obtained in 1942, the white-seeded selection *Pisum sativum* '163' has proved to be superior in yield and quality over the local variety and the former standard Kalianpur White in Uttar Pradesh. The selection was released in 1950.

4658 SOLOV'EVA, V. K.
(**New forms of culinary shelling pea**).
Agrobiologija (Agrobiology) 1958 : No. 5 : 124–26. [Russian].

Pea breeding at Gribovo is discussed and three hybrids which are thought to have breeding value are described. Štambovyj Polukarlik [Semidwarf Crown] (Čudo Ameriki 33 [American Wonder 33] x Štambovyj 071) is mainly interesting for late maturity, which it transmits to its hybrid progeny. The late cultivars Pozdnespelyj Mozgovoj 13–2 [Late Marrowfat 13–2], Sablevidnyj Mozgovoj [Sabre Marrowfat] and line 35 were all obtained from crossing it with Rostovskij Vysokij [Rostov Tall], Lord Robert and Čudo Kel'vedona 1378 [Kelvedon Wonder 1378] respectively. Line 35 is commended for its high quality and productiveness. Usatyj [Moustache] was selected for its unusual morphological features from the $F_9$ of Svoboda [Freedom] (Štambovyj Mozgovoj 3 [Crown Marrowfat 3] x Čudo Kel'vedona 1378). It has stipules and well developed tendrils but no leaflets and bears two

pods on a stalk. It produces high quality peas, sweeter than those of the standard variety Izumrudnyj [Emerald], and outyields it by a considerable margin. Another unusual form was obtained by crossing Usatyj with the French variety Akacija [Acacia], which has leaflets but no tendrils. The $F_2$ gave segregates of the parental types, intermediate types and new fertile forms of an unusual branched structure. The $F_2$ segregates having leaves and tendrils gave all four kinds of plants in the $F_3$; those with the morphological characteristics of Akacija and Usatyj gave these types and the new branched form; the segregates of the latter kind bred true in respect of their leaf character in the $F_3$. The new branched form is thought to be of use as the leaf construction prevents the plants from lodging.

4659 Sneddon, J. L., & Squibbs, F. L.
**Classification of garden pea varieties.**
J. nat. Inst. agric. Bot. 1958 : **8** : 378–422.

The work was chiefly undertaken at the National Institute of Agricultural Botany, Cambridge, England, 284 differently named stocks from 48 British seed firms being studied. Characters are given a detailed assessment as to diagnostic value. The varieties are placed in 32 main groups, according to characters of the seed and pod and to stem height. Full descriptions of 68 varieties are provided, points of difference being indicated for a further 83. In the discussion on maturity as a varietal feature, it is shown that number of nodes up to the first inflorescence is more constant from year to year than number of days between sowing and flowering; data are also included on the relationship between number of days from sowing to flowering and number of accumulated heat units during this period.

4660 Blixt, S.
**Cytology of *Pisum* III. Investigation of five interchange lines and co-ordination of linkage groups with chromosomes.**
Agri hort. genet., Landskrona 1959 : **17** : 47–75.

Using the methods described previously [XXVIII, 4893 and XXIX, 3276], the author has compared the caryotypes of five lines, in each of which one or more interchanges have been previously detected by genetical methods, with those of L110 and other lines considered to be normal. By this means it has been possible to show that Lamprecht's linkage groups I, II, III, IV, V, VI and VII correspond to the present author's chromosomes III, II, VII, IV, I, V and VI, respectively. Lamprecht's designations are to be adopted in future. The data also indicate that gene *A* lies on the short arm of chromosome I, *Pn*, *Cry*, *St*, *B* and *Gl* on the short arm of III, *Le*, *V* and *Un* on the short arm of IV, *Cp* on the short arm of V, *U* on the long arm of V and *R*, *Tl* and *Bt* on the short arm of VII. Evidence was obtained of duplications in chromosomes I and III in some lines.

4661 Lamm, R., & Miravalle, R. J.
**A translocation tester set in *Pisum*.**
Hereditas, Lund 1959 : **45** : 417–40.

A "basic" tester set of five translocations involving all the seven *Pisum* chromosomes is described and a survey is reported of meiotic investigations on $F_1$ hybrids from diallel crosses within the basic tester set and from crosses with the normal type. The translocations of the basic set have short interstitial segments; pairing at meiosis of translocation heterozygotes is fairly simple. Another tester set includes the basic set and three further translocations with long interstitial segments; in such a segment a chiasma is frequently formed with the effect of reducing crossing-over values, this being of particular use in mapping genes.
Genetical investigations of the linkage relations between the points of interchange and certain marker genes were carried out. It was found that chromosome 1 carries the genes *Gp* and *R* whereas Lamprecht has suggested that these occur on the chromosomes which he has labelled V and VII. Chromosome 2 was found to carry *A* and corresponds to Lamprecht's chromosome I. Chromosome 3, which is identical with Lamprecht's III, bears *St* and *B* and chromosome 5, carrying *Le*, corresponds to Lamprecht's IV. The other three chromosomes have not been investigated in this way but two of them probably correspond to Lamprecht's II and VI. The probable location of the centromeres of chromosomes 1, 2 and 3 and the probable occurrence of quasilinkage resulting from interaction between chromosomes across the cytoplasm are considered.

4662 Lamprecht, H.
Ein Gen für eingesenkte Radicula und seine Lage im Chromosom III von *Pisum*. (**A gene for sunken radicle and its position in chromosome III of *Pisum*).**
Agri hort. genet., Landskrona 1959 : **17** : 37–46.

In the two crosses studied, the *foveatus* character,

in which the radicle is sunken, forming a distinct depression in the surface of the seed, showed intermediate inheritance and was determined by a single gene, *for*, lying on chromosome III between *St* and *Gl* near *B*. Crossing-over values are noted for *K-Wb* in chromosome II and for *Cp-Te-Cr* in chromosome V.

4663 Bingefors, S.
Kvalitetsfrågor hos kokärter ur förädlingssynpunkt—en översikt. (**Quality problems in cooking peas from the point of view of breeding—a survey**).
Sverig. Utsädesfören. Tidskr. 1959 : **69** : 37–57.

Quality requirements in Sweden and the need for improvements by breeding are surveyed. Current commercial varieties include yellow peas free from a tendency towards green or grey coloration and green peas in which the colour does not fade, but an improvement in the seed form of green peas and in the seed size of both green and yellow peas is desired, combined with earliness. A new yellow pea, U03521 (Ambrosia II x U03801), has larger seeds than the older Torsdags III [Thursday III]. Current yellow varieties show little variation in protein content but are rather lower than some older land races and the green pea Concordia. The speed with which the peas become soft on cooking varies according to variety but also depends on cultural conditions. In tests conducted by the Swedish Seed Association, the shortest cooking time, 40–50 minutes, was needed by U03521; however, differences were not great and it is thought that, in breeding, tests should be used for eliminating inferior material, since little improvement in cooking quality is likely to be possible. Flavour has been little investigated in Sweden. Mention is made of some fungi and insects which damage the seeds and the possibility of breeding for resistance.

4664 Andersen, P. E.
Sortsforsøg med ærter til hjemmefrysning 1957. (**Variety trials with peas for home freezing, 1957**).
Kulde 1958 : **12** : 17–20.

On the basis of determination of contents of vitamin $B_1$, vitamin C, dry matter and alcohol-insoluble dry matter in six varieties, together with organoleptic assessments, the varieties Beta S1953, Imperial Toftø S1953, Perfection (dark skinned), Safir Toftø S1953 and Witham Wonder were found equally suitable for home freezing. Delikatesse was poorer in quality than the others.

4665 Buxton, E. W., Perry, D. A., Doling, D. A., & Reynolds, J. D.
**The resistance of pea varieties to *Fusarium* wilt.**
Plant Path. 1959 : **8** : 39–45.

In field experiments conducted at Rayne, Essex, and Yaxley, Peterborough, 44 out of 90 pea varieties were resistant to wilt caused by F. *oxysporum* f. *pisi*. Including previous observations on other varieties, 77 out of 146 are known to be resistant in Great Britain. Physiological races 1 and 3, but not 2, were prevalent in the experimental fields. There appears to be no correlation between morphological characters, maturity or particular commercial use and reaction to wilt. Most of the popular commercial varieties are wilt susceptible. Stocks of wilt-resistant peas can be raised by selecting segregating plants from primarily susceptible stocks, or by breeding new lines from crosses between resistant and susceptible varieties. Testing for wilt resistance by artificial inoculation in a glasshouse gave inaccurate forecasts of field performance, unless soil from infested fields was used.

4666 Maltais, J. B. & Auclair, J. L.
**Factors in resistance of peas to the pea aphid, *Acyrthosiphon pisum* (Harr.) (Homoptera : Aphididae). I. The sugar-nitrogen ratio.**
Canad. Ent. 1957 : **89** : 365–70.

Analyses of plants of the susceptible peas Perfection, Daisy and Lincoln and the resistant varieties Laurier, Champion of England and Melting Sugar revealed that the sugar/nitrogen ratio was 23·63–63·7% higher in the latter group.

4667 Auclair, J. L., Maltais, J. B. & Cartier, J. J.
**Factors in resistance of peas to the pea aphid, *Acyrthosiphon pisum* (Harr.) (Homoptera : Aphididae). II. Amino acids.**
Canad. Ent. 1957 : **89** : 457–64.

During the stages of growth corresponding to the usual period of aphid infestation in the field, the susceptible varieties Perfection, Daisy and Lincoln generally contained a higher concentration of free and total aminoacids than the resistant varieties Laurier, Champion of England and Melting Sugar.

4668 Cartier, J. J.
**Recognition of three biotypes of the pea aphid from southern Quebec.**
J. econ. Ent. 1959 : **52** : 293–94.

When three lines (R1, R2 and R3) of *Macrosiphum pisi* were reared simultaneously for nine

days at 69° F., each on one susceptible (Perfection) and two resistant (Pride and Onward) varieties of pea, the lines differed in mean weights, number of females produced and rate of reproduction. The last mentioned was affected by a mechanism that interfered with the production of nymphs after two, three or five days, depending on the biotypes and host varieties tested. Both the parent females and their progeny were undernourished on the resistant varieties. The mechanisms of resistance may not be entirely dependent on the host since the feeding behaviour of different biotypes can alter considerably the degree of resistance.

4669 Otosson, L.
**Kemisk ogräsbesprutning i ärter: Olika sorter har olika känslighet. (Chemical weed-spraying in peas: different varieties show different susceptibility).**
Lantmannen, Stockholm 1959 : **70** : 405–06.

In Swedish tests of weed killers of the butylphenol type, little difference in resistance was found among commercial pea varieties, but some of the newer varieties, notably Serpette amélioré [Improved Pruning-knife], were more susceptible, apparently because their leaves were readily wetted.

4670 Bate-Smith, E. C., & Ribéreau-Gayon, P.
**Leuco-anthocyanins in seeds.**
Qual. Plant Mater. veg. 1959 : **5** : 189–98.

The seeds of angiospermous plants of several orders were examined. The seeds of the herbaceous Leguminosae with a few exceptions contain leucoanthocyanins; in the exceptions this character seems to be genetically controlled. Culinary varieties of *Pisum sativum* do not contain leucoanthocyanins but field varieties do. Crosses between the two types produce seeds which are mottled or entirely leucoanthocyanin positive.

4671 Sahai, J. M., Singh, S. P. & Mehta, T. R.
**Breeding work on gram (*Cicer arietinum* Linn.) in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955: **6** : No. 2 & 3 : 21–31.

A review is given of breeding *C. arietinum* in Uttar Pradesh since its initiation in the early thirties.

4672 Bhatnagar, P. S.
**Breeding improved arhar (*Cajanus cajan* Mill sp.) in Uttar Pradesh.**
Agric. Anim. Husb. Uttar Pradesh 1955 : **6** : No. 2 & 3 : 38–41.

An historical account is given of improvement of *C. cajan* by selection, initiated in 1932, with headquarters at the Government Research Farm, Kanpur. Hybridization to develop varieties combining high yield and large seeds is to be undertaken.

4673 Reitsema, R. H.
**A biogenetic arrangement of mint species.**
J. Amer. pharm. Ass. : Sci. Ed. 1958 : **47** : 267–69.

On the basis of chemical and genetical studies, a scheme for the biosynthesis of the various components of mint oils in different species is presented. There are three types of oils, characteristic respectively of the spearmints (2-oxygenated-*p*-menthanes), peppermint (3-oxygenated-*p*-menthanes) and lemon mint (acyclic compounds); the first two contain a parallel series of compounds which undergo similar reactions.

## ECONOMIC LOWER PLANTS

4674 Morpurgo, G., & Sermonti, G.
**Chemically-induced instabilities in a heterozygous diploid of *Penicillium chrysogenum*.**
Genetics 1959 : **44** : 137–52.

Conidia of a diploid strain of *P. chrysogenum* heterozygous for colour and deficiency markers were treated with nitrogen mustard. This treatment greatly increased the frequency of segregates occurring both as whole colonies and as yellow or white sectors in otherwise green colonies. The frequencies of such mosaic colonies in successive generations of several mosaic clones were recorded and an appreciable increase in segregation rate was noticed. It appears that the tendency to produce progeny with a high proportion of mosaic colonies behaves as a hereditary factor. Some mosaic colonies gave rise to green daughter colonies; this is thought to be due partly to incomplete penetrance of the character for high segregation frequency and partly to reversion of the character to the normal state. Unstable clones showed specificity of segregation pattern, each clone producing only one or two types of segregate sector; nevertheless other markers were found to be present in the heterozygous state in these clones. An unstable clone has also been

derived from a mosaic colony which arose spontaneously. The most likely cause of the instability observed is thought to be an increase in the rate of occurrence of somatic segregations.

4675 Imšeneckij, A. A., Solnceva, L. I. & Kuranova, N. F.
**(Experimental production of active variants of *Aspergillus niger* forming citric acid).**
Dokl. Akad. Nauk SSSR (Proc. Acad. Sci. USSR) 1959 : **124** : 925–27. [Russian].

Descriptions are given of an industrial strain 6/5 and a more active variant $T_1$ which was obtained by selection following ultraviolet irradiation of 6/5. The treatment involved four irradiations and four selections, the mutants obtained in this way being regarded as more constant than those from a single radiation and selection cycle.

4676 Bočarov, S. N.
**(Hybridization of industrial races of yeast. III).**
Trud. Inst. Genet. (Trans. Inst. Genet.) 1958 : No. 24 : 251–67. [Russian].

Data on the fermentation of malt wort show that 11 out of 41 hybrids tested exceeded both parental strains in rate of fermentation, 25 being intermediate, 4 equal to the better parent and only 1 inferior to both. One hybrid produced 3·20 g. of $CO_2$ per 100 ml. from a 12° wort in 10 days compared with 2·90 g. from a commercial strain; another hybrid produced 4·82 g. $CO_2$ per 100 ml. over a 15-day period from a 16° wort. In another set of 24 hybrids tested in 10° molasses, 9 exceeded both parental strains in rate of fermentation. Altogether, 40% of the hybrids tested exceeded both parents in capacity for fermentation.

Some of the hybrids exceeded the parental strains in capacity to absorb oxygen and in the volume increase produced in dough samples.

Inheritance studies showed certain characters to be dominant; these included rough colonies, elongate cell form and cell size. Certain characters, such as rough surface of colony, appeared occasionally in hybrids of two races, neither of which possessed the character. Certain races gave rise to hybrids in which a large proportion of the spores produced viable offspring.

$F_2$ cultures displayed reduced capacities for multiplication and fermentation, the degree of reduction varying in different hybrid combinations.

The best method of maintaining the hybrid strains was found to be in agar wort, with monthly transfers through wort.

4677 Yanagishima, N.
**Induction of a respiration-deficient variation in yeast by pyronin B.**
Naturwissenschaften 1959 : **46** : 151–52.

It has previously been found that p-nitrophenol and copper induce respiratory deficiency in *Saccharomyces ellipsoideus*, the respiratory variant, which is designated W, having some characteristics in common with the petites of *S. cerevisiae*. Pyronin B has now been found to induce the formation of W variants in a diploid strain of *S. ellipsoideus*. Since pyronin B has a high affinity for the RNA in yeast, it is thought that the induction of W variation may involve an alteration in the RNA metabolism.

4678 Saenko, N. F. & Saharova, T. A.
**(The effect of cultural conditions on the growth and biochemical activity of sherry yeasts).**
Vinodelie Vinogradarstvo SSSR (Winemak. & Vitic. USSR) 1959 : No. 2 : 19–23. [Russian].

Mention is made of the new strains Heres 96–K [Sherry 96–K] and Heres 96–5 which are tolerant of 16–17% alcohol. They were obtained by gradual adaptation of Heres 20–S to increased concentration of alcohol.

4679 Górzyńska, J.
Poszukiwania nowych ras drożdży na drodze hybrydyzacji. **(Seeking new yeast varieties by means of hybridization).**
Acta Microbiol. Polon. 1957 : **6** : 189–206.

Of three new hybrids produced at the Warsaw Institute of the Fermentation Industry, two, B and G, were obtained by hybridization of the bakers' yeast strains As and Luboń and the third, $S_1$, by hybridization of the distillers' yeast strains Ja and 0–11. The fermentation capacity of hybrids G and $S_1$ was of the order of that of the parental varieties, while that of hybrid B was 3·3% higher than that of As and 5·5% higher than that of Luboń. Unlike their parental varieties, B and G did not ferment galactose, but in other physiological characters they appeared to resemble their parents.

4680 Streutker, R. T.
**Some strain differences in brewers yeasts.**
Wallerstein Labs. Commun. 1959 : **22** : No. 76 : 27–45.

Evidence has been obtained suggesting that differences in the utilization of nitrogen sources may be useful as a means of distinguishing

strains of *Saccharomyces carlsbergensis* or *S. cerevisiae.*

4681 Barnett, J. A.
**The coexistence of haploidy and diploidy in yeasts.**
Experientia 1959 : **15** : 99–100.

It is known that a normal vegetative population of yeasts may be a mixture of haploid and diploid cells of the same strain. Wickerham has suggested that haploidy is a primitive condition and that the ratio of haploid to diploid cells indicates the level of evolutionary development. Taking into account the fact that yeasts occur in rapidly changing habitats and multiply rapidly, it is suggested, as an alternative to Wickerham's idea, that the coexistence of haploid and diploid cells is advantageous. The existence of diploid cells enables mutant recessive genes to spread masked by the wild type in the heterozygote; thus diploidy provides a stable phenotype and the possibility of genetic variation. Also with diploidy heterosis is possible. Haploidy on the other hand makes possible the rapid appearance of mutant characters which are masked in diploids; an advantageous mutant gene would spread quickly when present in haploid cells. Since both haploid and diploid cells can reproduce asexually and coexist whilst being genetically separate, the advantages of haploidy and diploidy may be achieved together.

4682 Takahashi, T.
**Complementary genes controlling homothallism in Saccharomyces.**
Genetics 1958 : **43** : 705–14.

At the University of Tokyo, a Carbondale heterothallic strain was crossed with a haploid segregate arising from a hybrid between homothallic and heterothallic strains; many of the zygotes so obtained segregated into one diploid and three haploids. It is supposed that complementary genes designated $HM_1$ and $HM_2$ are responsible for the expression of the homothallic character; the genotype $\frac{HM_1\,HM_2}{MH_1\,HM_2}$ produces a homothallic diploid and the absence of either or both of these genes gives a heterothallic haploid. This hypothesis was supported by the results of other crosses.

4683 Rigone de Pritz, M. J. A. & Vega, R.
Levaduras vínicas de San Juan. (**Wine yeasts of San Juan**).
Bol. téc. Fac. Cienc. agrar. Univ. Cuyo 1958 : No. 17 : Pp. 40.

Data on resistance to $SO_2$ and high temperatures, fermentation characters and the quantity of lees, rate of clarification and flavour of the wine produced are given for 45 strains of yeast isolated from musts in the San Juan province of Argentina.

4684 Iguti [Iguchi], S.
**On the ploidy of *Torula rubra* Saito.**
Shokubutsugaku Zasshi/Bot. Mag., Tokyo 1959 : **72** : 87–90.

The survival curve of *T. rubra* irradiated by 2618 Å. ultraviolet light extrapolates to a survival fraction of 1·0. In this respect it resembles haploid *Saccharomyces cerevisiae* and differs from diploid *S. cerevisiae* which extrapolates to a point around 2·0. It is therefore inferred that *T. rubra* is probably haploid.

4685 Kneebone, L. R.
**High yielding mushroom from irradiated spores.**
Sci. Fmr., Pa. 1959 : **6** : No. 4 : p. 14.

Selection of improved strains from untreated spores and spores treated with ultraviolet, $\gamma$ or thermal-neutron radiation is receiving attention at the Agricultural Experiment Station, Pennsylvania State University. Culture 286, derived from an ultraviolet-induced mutant spore and introduced to growers in 1952, has outyielded the commercial controls by up to 31%. Its faster growth permits earlier picking, as well as a longer picking season, since the number of nonproductive days is reduced. Mention is made of four other induced mutants, two superior in vigour and yield and two light-coloured mutants from brown parents.

4686 Evans, H. J.
**Nuclear behaviour in the cultivated mushroom.**
Chromosoma 1959 : **10** : 115–35.

The number of nuclei in the hyphal cells was found to vary between 1 and 36, the mean being $6{\cdot}44 \pm 0{\cdot}08$, but the cells in the hymenium were always initially binucleate. Nuclear migration between cells was observed, the nuclei passing through small connecting tubes between the cells. Resting nuclei were found to be in either an "expanded" state with a granular appearance or in a smaller "homogeneous" state; the two conditions reacted differently to stains. It is suggested that homogeneous nuclei are characteristic of cells in an active metabolic condition. Centrosomes were not observed during either mitosis or meiosis and clamp connections and conjugate mitotic spindles were also not seen. The chromosome number was found to be $n = 12$, and 12 bivalents were formed regularly in the fusion nucleus during meiosis in the basidium. Chromosome bridges occurred at

anaphase I and II; the presence of fragments with some bridges indicated the existence of inversion heterozygosity. Laggard chromosomes were also observed at meiosis and mitosis; this may have resulted from adhesion between heterochromatic regions.

Differences were noted in the alignment of the two spindles at the second division of meiosis in the basidia. The nuclear constitution of the basidiospores depended upon the type of spindle alignment; in the material examined, the frequency of basidiospores having sister nuclei was quite low. The high production of spores containing nonsister nuclei maintains a high degree of heterocaryosis without nuclear exchange occurring between plants.

# BOOK REVIEWS

4687 Bailey, N. T. J.
**Statistical methods in biology.**
English Universities Press, Ltd., London 1959 : 25s. : Pp. ix + 200 : tables.

Reputable books on first aid combine practical directions for dealing with such situations as arise with insistent instructions that professional help be called in whenever the circumscribed field of usefulness of the layman is overstepped. Dr. Bailey takes a similar line. A clear and readable introduction to the more commonly used techniques of applied statistics is given with constant warnings as to when professional statistical advice is to be sought.

The topics covered include the more common frequency distributions, standard errors and confidence limits, significance tests, the $t$ test, $\chi^2$, correlation, regression, analysis of variance, with special reference to randomized blocks, factorial experiments, random samples and random numbers, and partial correlation and regression. So many elementary introductions to statistics have been published in recent years that it is not altogether easy to differentiate between them. The present volume has biological applications constantly in the foreground and, conceding the rarity of the bivariate normal distribution, advocates regression analysis rather than correlation.

The gulf between the nonmathematical biologist and the statistician is not crossed. An occasional complicated equation is given, as for the normal curve, but the reader is hurriedly assured that no direct use will be made of it. Like a doctor's prescription, it seems intended to overawe rather than serve the patient's well-being.

Two unusual and useful features are a chapter on desk calculating machines and a summary of statistical formulae. An omission from this and similar introductions is any reference to approximate methods based on range, but perhaps Dr. Bailey considers that these, like tranquillizers, should only be used after professional approval has been given.

4688 Bonnier, G. & Tedin, O.
Biologische Variationsanalyse.
**(Analysis of variation in biology).**
Verlag Paul Parey, Hamburg & Berlin 1959 : 2nd Ed. : DM 24 : Pp. 204 : figs. : tables.

The second edition of this standard Swedish introduction to statistical methods in biology [cf. XXVIII, 2414] now appears in German translation. The translation seems to be accurate and to retain the clarity of the original Swedish. The useful system of numbering the chapters, sections, tables and examples, allowing easy reference to any particular point, is retained and the layout of some of the tables has been improved. It may be expected that this volume will be as useful in German-speaking countries as the original has proved in Scandinavia.

Bugher, J. G., Coursaget, J. & Loutit, J. F. (Editors)
**Progress in nuclear energy. Series VI. Biological Sciences. Volume 2.**
Pergamon Press, Ltd., London 1959 : £5 5s. : Pp. x + 422 : figs. : tables.

The editors of this volume have chosen from the papers presented to the 2nd International Conference on the Peaceful Uses of Atomic Energy those in the biological fields which appealed to them as representative of local interest in some part of the world, of general interest at the present time or of permanent historical value. The volume follows up many of the subjects discussed at the 1st Conference in 1955 [cf. XXVII, 3751–59]. Many of the contributions dealt with zoological objects. Those dealing with plants or microorganisms were the following.

4689 *Ouang, T. Y. & Chang, W. T. Mutations in rice induced by X-radiation. (pp. 22–28).*

The rice cultivars Pei-ko and Kisshin when treated with X rays at various dosages showed

varying degrees of sterility in the progenies. In pollen mother cells of semisterile plants both quadrivalents and univalents were observed at diacinesis and metaphase I, their frequency varying in different strains. The $X_2$, $X_3$ and $X_4$ generations from semisterile plants contained a number of mutants differing in height, tillering, date of heading and fertility. Many of the dwarf mutants were shown in back crosses to be due to a single recessive.

4690 *Haas, F. L. & Doudney, C. O. Interrelations of nucleic acid and protein syntheses in radiation-induced mutation induction in bacteria.* (*pp. 167–78*).

Incubation of *Escherichia coli* in certain substances such as p-aminobenzoic acid and riboflavin before irradiation with UV increased the mutation frequency; ribosides had the same effect. If on the other hand the substances were supplied after irradiation they were without effect but the withholding of aminoacids in this period reduced the number of mutants. The results suggest that the mutagenic effect of UV consists in modification of intracellular nucleic acid precursors, interfering with the basic processes of gene replication; these processes apparently involve DNA, RNA and protein syntheses.

4691 *Powers, E. L., Webb, R. B. & Ehret, C. F. Modification of sensitivity to radiation in single cells by physical means.* (*pp. 189–98*).

The results reported indicate that there is, in the bacterial spore, a thermally-induced reversible change in state (A $\rightleftharpoons$ B). State A exists below 310° K and state B exists above 373° K, and the shift from A to B is not instantaneous. Between these two temperatures the two states occur in varying equilibrium ratios. While in state A, the spore is radiation sensitive; while in B, it is resistant.

4692 *Biebl, R. The radiosensitive phase in plant germination.* (*pp. 258–64*).

Plants of Austro-Bankut winter bearded wheat and of soya bean were most sensitive to X rays on the second day after germination.

4693 *Bora, K. C. Factors affecting the relative biological efficiencies of ionizing radiations.* (*pp. 278–99*).

Data from the literature are examined and it is shown that the relative biological efficiency varies with the type of radiation, with the effect considered, the dose, environment, the presence or absence of oxygen, temperature and genic composition. It is pointed out that induction of mutations by radiations cannot be explained by the target theory alone and much still remains to be learned concerning the nature of the gene.

4694 *Dubinin, N. P. The mechanism of the effect of radiation on heredity and the problem of radiosensitivity.* (*pp. 321–35*).

The types of chromosome aberration arising after irradiation with UV, visible light and ionizing radiations are compared and a report given of the aberrations observed in the germ cells of monkeys two years after X irradiation with 150–450 r., in fish embryos after irradiation with 10,000 r. and in male germ cells of *Drosophila* after irradiation with 1000 and 4000 r. When 98 agricultural plants were exposed to $\gamma$ radiation from $Co^{60}$ at doses of 5000–100,000 r. it was shown that the cruciferous plants were the most sensitive. The effects of thermal neutrons following $\gamma$ radiation were studied in detail for the spring wheat Lutescens 62; the cells displayed a number of mitotic disturbances and an increased nucleolar volume. The roots of pea varieties showing the greatest sensitivity to radiation contained less heteroauxin than those of more resistant varieties.

Further experiments reported show the capacity of ethylenediaminetetraacetic acid to produce chromosome fragmentation. The leading role of DNA in phage infection has been demonstrated. Mutants of *Actinomyces* with increased capacity for streptomycin synthesis are characterized by high DNA content in the first phase and reduced DNA content in the second phase of their growth in culture.

4695 *Sparrow, A. H. & Schairer, L. A. Some factors influencing radioresistance and tumor induction in plants.* (*pp. 351–58*).

Species of *Chrysanthemum* ranging in chromosome number from $2x = 18$ in *Ch. nipponicum* to $22x = 198$ in *Ch. lacustre* were irradiated in the $\gamma$-radiation field at the Brookhaven National Laboratory, N.Y. Counts of the number of plants that died showed all the polyploid species to be more resistant than the diploid at doses both of 1340 r. and 450 r. per day, the resistance being roughly equal to the degree of ploidy. Nine species of *Sedum* with chromosome numbers ranging from 20 to 68 also showed a linear correlation between resistance and chromosome number. Examination of the cells has shown that growth and cell division can continue in high polyploids even when a high degree of chromosome aberration exists.

Exposure of the top two inches of seedlings of the hybrid *Nicotiana glauca* x *N. langsdorffii* to

X rays increased the rate of tumour formation in the irradiated zones but not in the protected zones below. Irradiation of other parts of the plant led also to localized response, though the localization in this case was not quite so complete. Treatment with triiodobenzoic acid caused rather similar tumours and their origin is thought to be due possibly to disturbance of the auxin metabolism rather than to mutation or chromosome aberration. This conclusion is supported by the incidence of tumours in *Graptopetalum paraguayense* after $\gamma$ irradiation.

4696 *Kuzin, A. M. & Shabadash, A. L. The role of nucleoprotein native state changes in radiation damage.* (*pp. 364–78*).

Chloroplasts, which contain relatively small amounts of nucleic acids, proved highly insensitive to ionizing radiation, those of some plants tolerating doses of 50,000 r.; the chloroplasts of young cells, which have a higher nucleic acid content, were more sensitive than those of old cells. Experiments with mitochondria isolated from irradiated animal liver suggested that irradiation caused inhibition of oxidative phosphorylation. Histochemical observations showed that ionizing radiation changes the physicochemical characteristics of the ribonucleoprotein constituents of various cell components, those of different structures such as mitochondria, nucleolus and ergastoplasm reacting differently according to the number of free phosphate groups in their nucleoprotein complex.

4697 *Meisel', M.* et al. *The action of ionizing radiations and radiomimetic substances on the microbe cell.* (*pp. 379–93*).

Experiments with various yeasts showed that irradiation reduces the enzymatic activity of the mitochondria, oxidative phosphorylation and the transamination processes being particularly affected. Certain other processes, including deoxyribonuclease activity, were stimulated. The processes of protein synthesis in the microsomes were also deranged after irradiation.

4698 Rudnick, D. (Editor)
**Developmental cytology.**
Ronald Press Company, New York 1959 : $7.00 : Pp. v + 215 : 28 figs. : 9 tables : 23 plates.

The Sixteenth Symposium of the Society for the Study of Development and Growth was organized around the cell itself. It was held at Kingston, Rhode Island, on 19–21 June 1957 and the papers presented are comprised in the present volume. The delay of almost two years in publication deprives them of some of the interest they would have possessed if published immediately but this notwithstanding the papers provide a useful survey of a field that has undergone rapid development in recent years.

In Nuclear and cytoplasmic differentiation in the protozoa, J. R. Preer examines a number of changes associated with the life cycle in ciliates. Though recognizing the unsatisfactory nature of an hypothesis assuming the operation of alternative steady-state reactions, the author concludes that the genetics of mating-type substances and the immobilization antigens in *Paramecium* appear to fit no other scheme. Most of the other cases of cytoplasmic inheritance in this group can be interpreted on a similar basis and it is suggested that perhaps there is an autocatalytic step in protein synthesis.

In Quantitative chromosomal changes and differentiation in plants, C. R. Partanen reviews some of the known cases of somatic chromosomal variability in plants, including somatic polyploidy and somatic reduction, passing on to describe some experiments in which tumours in fern prothalli were shown to consist largely of polyploid and aneuploid cells. The values of DNA per nucleus were also more variable in these cells. Tumours of *Helianthus tuberosus* produced by *Agrobacterium tumefaciens* however showed little or no deviations from the diploid number.

T. C. Hsu spoke on Numerical variation of chromosomes in higher animals; the Chinese hamster, with 11 pairs of morphologically distinguishable chromosomes, can be bred with ease and is considered the ideal material for experimental studies. Nuclear and cytoplasmic changes in tumours were dealt with by G. and E. Klein, who cited data showing that both chromosome number and DNA values are higher than normal in primary tumours; each tumour tends to have a characteristic number, which suggests that it arose from a stem-line cell with an aberrant number, usually aneuploid rather than polyploid.

W. Beermann spoke on Chromosomal differentiation in insects, giving special attention to the puffs or Balbiani rings in polytene chromosomes and concluding with the observation that puffing is apparently confined to the euchromatic portions of the genome and that the nature of heterochromatin remains one of the mysteries of cytogenetics and cellular physiology.

Changes in nucleoli related to alterations in

cellular metabolism were discussed by H. F. Stich, who presented evidence suggesting that "at different parts of the chromosome substances accumulate with different chemical composition, different metabolic activity, and different response to external stimuli". Other experiments suggest that the size of the nucleoli depends on the amount of energy-rich phosphates in the cytoplasm. By grafting normal nuclei of *Acetabularia* to cytoplasm treated with RNase it was shown that the nucleus may contribute to the cytoplasm one or more compounds which act as "starters", after which the cytoplasm attains autonomy in RNA and protein synthesis.

D. von Wettstein spoke on Developmental changes in chloroplasts and their genetic control; the structure of the chloroplasts in a number of different species is described, together with the author's views on the development of a proplastid into a chloroplast. The question whether chloroplasts can multiply only by division or can be condensed from the cytoplasm is, we are told, still open. An analysis of the data of plastid deficiencies in barley shows that many of these are conditioned by genes that cause a block in the developmental chain leading to the lamellar organization of the plastid. Some of the resulting anomalies are illustrated by micrographs. Other genes control the synthesis of the actual pigments, others the photostability of the newly synthesized pigments, whilst it is probable that others not yet analysed will be found to control the synthesis of such substances as proteins, nucleic acids and enzymes.

The next contribution is Changes in the fine structure of the cytoplasmic organelles during differentiation, by D. W. Fawcett, who gives details of the submicroscopic structure of a number of cytoplasmic organelles as it is now known from the electron microscope; these include the recently discovered endoplasmic reticulum, which is considered to be "an extremely pleomorphic organelle, capable of changing rapidly from one form to another in different physiological conditions". Tubular elements of the endoplasmic reticulum often extend through intercellular bridges joining the cells in groups of cells that exhibit synchronous differentiation, as in the case of the spermatocytes in many animal species and the nematocysts in *Hydra*.

The final contribution is Metabolic interactions in cell structures, by A. L. Lehninger. Respiratory activity in the mitochondria, synthesis of nucleotide coenzymes and other enzymes in the nucleus, incorporation of nucleotide precursors into RNA in the endoplasmic reticulum (microsomes), various hydrolytic activities in the lysosomes and the pentose cycle in the cytoplasmic sap are some of the activities that have been localized in certain specific cell structures, and various more complex cases of compartmentalization are then examined. The structure of the mitochondrion as seen in the electron microscope is described; it is calculated that a single mitochondrion may contain thousands of complete respiratory-phosphorylating assemblies in the membranes, this system being actively associated with the movement of water into and out of the mitochondrion and also probably the passage of ions.

4699 HAYASHI, T. (Editor)
**Subcellular particles.**
Ronald Press Co., New York 1959 : $6.00 : Pp. viii + 213 : figs. : tables.

The Society of General Physiologists devoted its fifth annual symposium to the subject of subcellular particles on 9–11 June, 1958, at Woods Hole, Mass., and the present volume embodies the proceedings. The first contribution was on Approaches to the *in vivo* function of subcellular particles, by A. B. Novikoff, who outlines some of the knowledge gained by the application of modern techniques, concluding that it is becoming more and more difficult to distinguish a biochemist from a microscopist; with this unification of approach goes an ever increasing complexity of the structures seen and studied. A. D. McLaren and K. L. Babcock spoke on Some characteristics of enzyme reactions at surfaces, showing how the concentration of H ions may be as much as 2 pH higher than in the solution; the view is put forward that in cells, enzymes operate as parts of structures and that a new kind of enzyme kinetic theory is required to explain this operation. In Structural factors in polymerization: the matrix in aromatic biopolymer formation, S. M. Siegel described the conversion of eugenol and certain other compounds to a lignin-like substance by vascular tissues containing peroxidase, by filter paper impregnated with peroxidase, by pectic substances, and by certain mineral substances; polymerization of quinone by fibrin and by protein led to the production of polyquinones having close resemblances to natural melanins produced by sponges and other organisms; the oxidation of pyrogallol was increased greatly by Mn and Co and the product of catalysis showed greater resemblances to natural purpurogallin than those catalysed by other elements. It is concluded that catalytic activity in the cell is

probably not confined to organelles and enzymes and that almost any macromolecule, crystal surface or phase boundary may possess such activity.

G. E. Palade, in Functional changes in the structure of cell components, described changes in the mitochondria, endoplasmic reticulum and zymogen granules in the exocrine pancrease of starved guinea pigs when studied with the electron microscope. D. E. Green, in Mitochondrial structure and function, gave a fascinating outline of the work of the Wisconsin group on the mitochondria of beef heart muscle; it is now possible, for instance, with the electron microscope, to distinguish between phosphorylating and nonphosphorylating electron transport particles and the mitochondrion is envisaged as a polymer of a repeating unit, believed to be the electron transport particle or a subunit of it, there being several thousand such units per mitochondrion. When the mitochondrion is damaged it develops various enzyme activities that it does not possess when intact and the same seems to be true of the electron transfer particle; this is apparently made up of limited numbers of protein components linked in a very precise manner by chemical bonds, the entire chain being "of bewildering complexity"; some of the components have however been identified: flavoproteins, cytochromes, lipoproteins, Fe, Cu and possibly Mg and other metals. Certain fixed components are apparently incapable of reacting with one another and can do so only by the intervention of smaller molecules which "shuttle electrons from one to the other", operating within lipoproteins which "bridge together pairs of fixed components". M. D. Kamen and J. W. Newton spoke on Particles in photosynthetic phosphorylation, describing the chromatophores of photosynthetic bacteria, which in most of their properties resemble the chloroplasts of green plants but are more accessible to study. Biochemical studies of isolated Golgi mechanisms were described by E. L. Kuff and A. J. Dalton, who found lipid phosphorus and high acid phosphatase activity to be their most characteristic properties, other enzymatic activities being markedly absent. Lysosomes, a new group of cytoplasmic particles, were described by C. de Duve; they differ from the mitochondria in bearing acid phosphatase and possibly also ferritin; it is thought that they are involved in processes of acid hydrolysis and that the "segregation of the lysosomal hydrolases within little impermeable bags may play an essential part in keeping the lytic processes localized and, therefore, in protecting the cell against generalized autolysis".

Intermediate reactions in protein synthesis were considered by a group of authors headed by M. L. Stephenson, dealing with the incorporation of aminoacid into protein by the microsomes in cell-free systems. The results show that the aminoacids are incorporated into a long polypeptide chain, the initial site being the ribonucleoprotein particles; the various steps apparently involve ATP and soluble RNA, there being indications of the existence of several specific RNA molecules, possibly corresponding to the different aminoacids. This paper was followed by one on *In situ* studies of polynucleotide synthesis in nucleolus and chromosomes, by J. H. Taylor and P. S. Woods; in their experiments on roots grown in solutions containing tritium-labelled thymidine, the isotope was incorporated almost exclusively into the nuclei. When these nuclei divide, unequal distribution of the label in the chromosomes suggests that duplication does not begin simultaneously at all points along a chromosome and, further, that variations may occur among individual chromosomes of a set. The degree of asynchrony differs in different species. When the labelled chromosomes pass through a second duplication they yield one labelled and one nonlabelled chromatid; chromatid interchanges lead to chromosomes labelled along part of their length only. The findings are taken as support of the hypothesis that DNA replicates by a template mechanism. Analysis of the frequency and pattern of chromatid exchanges indicates that the two units of DNA are structurally different, supporting the concept that they represent complementary sites. Incorporation of tritium-labelled cytidine in root tips of *Vicia faba* was confined to the RNA of the nucleolus; there is evidence for the existence of two types of RNA, one with a lower rate of turnover, which may be the template required for synthesis of RNA. The last contribution was by V. Allfrey, on Biochemical properties of the isolated nucleus, in which it was shown that thymus nuclei suspended in a buffered sucrose medium absorb isotopically labelled aminoacids, which are incorporated in the nuclear proteins; this activity is inhibited by deoxyribonuclease but restored by DNA, RNA, polynucleotides and certain related compounds. Adenosinetriphosphate activity was also destroyed by deoxyribonuclease. Substitution experiments showed that more than 75% of the DNA can be replaced by comparatively simple molecules, so long as they are negative in charge, without losing its

activity, which seems to depend on its polyanionic nature.

4700 Crook, E. M. (Editor)
**The structure and function of subcellular components. Biochemical Society Symposium No. 16.**
Cambridge University Press 1959 : 15s. : figs. : plates : tables.

New techniques, such as fixation with $KMnO_4$, and improvements of existing techniques have made it possible to discern more and more of the structure of the cytoplasm and its inclusions, so that structures smaller than 50Å can now be studied fairly accurately with the electron microscope. Some of the main facts that have emerged from these new studies are outlined in the first contribution to this symposium, by J. D. Robertson, on The ultrastructure of cell membranes and their derivatives. The question as to whether the endoplasmic reticulum comprises a closed intracellular system of membranes still remains to be settled. However a three-layered structure ~75Å thick, consisting of two dense lines ~20Å thick bordering a light central zone is seen at the surface of a number of dissimilar cells. It is thought reasonable to assume that the ~75Å unit represents one bimolecular leaflet of lipid, the polar surfaces of which are covered by monolayers of non-lipid material. Since it was shown that this structural pattern is common to many cells it seems clear that it may be generally present.

In Principles and potentialities of cytochemical staining methods for the study of intracellular enzyme distributions, S. J. Holt describes experiments with a series of some 40 indoxyl acetates in which various substituents had been placed singly or in combinations in the six-membered ring of the indoxyl molecule; very good definition was obtained with 5 : 5′-dibromo-4 : 4′-dichloroindigo, which made it possible to establish that esterase activity is confined mainly to certain intracellular granules. The enzymatic role of the mitochondria was discussed in Distribution and interaction of enzymes within animal cells by L. Ernster, who presents evidence showing the existence of two separate pathways of pyridine nucleotide oxidation, one of them not connected with phosphorylation. It is no longer the enzymes that are regarded as labile but the structure in which they operate. Thus it is now envisaged that the mitochondrial structure contains an ATP-dependent, "contractile" principle, which functions as a regulator of the enzymic organisation of the mitochondrion. It might be visualized that, in the "contracted" state, this principle maintains the catalytic sites responsible for the transfer of high-energy bonds in a tight pattern, preventing them from reacting with water; when the principle is "relaxed", water gains access to the enzymic sites, with a hydrolysis of the high-energy bonds as a consequence.

P. Mitchell, in Structure and function in microorganisms, develops the view that enzymes are involved in all movement of substances across a membrane, the catalysts of translocation being proteins or related bodies. Evidence is presented showing that a membrane consisting of one monolayer of lipid and one of protein surrounds the bacterial cell as it does the mitochondrion in cells of higher organisms, which moreover is roughly of the same size. It is further postulated that the lipoprotein particles of the membrane contain the cytochrome system and that "the apparent functional specialisation of the catalysts of membrane transport may not be a consequence of structural and inherent functional peculiarity, such as the special elastic and propulsive properties required of the protein of the 'propelled shuttle' mechanism of active transport described by Danielli (1954); but may be a direct consequence of the situation of enzymes or carriers in the membrane". It follows from this that mutants lacking a particular transport capacity may do so owing to a change of location of a protein component rather than to its loss.

The last contribution is by J. D. Judah and K. R. Rees on Changes in cellular components in liver injury, in which it was reported that mitochondria were reduced in numbers and activity in rat liver during carcinogenesis; at the same time there was an increase in the rate of protein synthesis in the nuclei.

4701 Turrill, W. B. (Editor)
**Vistas in botany.**
Pergamon Press, London 1959 : £5 : Pp. xv + 547 : figs. : plates.

The Royal Botanic Gardens at Kew have in the course of their two centuries of activity embraced a wide area of botanical activities and this volume, published in commemoration of the bicentenary of the Gardens, does the same. It starts with a preface in which the Editor presents an historical outline of the development of the gardens since their inauguration, in 1759, by the Princess Augusta Saxe-Gotha, mother of King George III. There is also a foreword by the present Director, Dr. G. Taylor. There

follows a series of essays by eminent botanists, each surveying the main developments in a particular field of botanical study over the two centuries during which the Gardens have existed. Taxonomy: general principles and angiosperms, is surveyed by H. J. Lam, who in an erudite essay shows that, as he cogently puts it, "an irrelevant question put to Nature necessarily results in an inane reply" and dispels a number of illusions, throwing some doubt on certain concepts such as regressive evolutionary series, primitive and advanced features, and many phylogenetic systems. The notion that taxa are natural entities is regarded as largely a phantasy and the species is considered the lowest category to which the International Code of Botanical Nomenclature can apply. A motley array of views all differing from the Goethean concept of metamorphoses in floral structure is presented. It is pointed out that the existence of double fertilization as a common feature throughout the Angiosperms rests largely on assumption, since not all genera, or even families, have actually been investigated; the author associates himself with those writers who consider that the Angiosperms derive from the Pteridosperms with a cupule with many seeds and that they are what he chooses to call birheithric, having originated from "fairly antipodal groups of the Pteridosperms, one with stachyosporous, the other with phyllosporous tendencies". He also considers the possibility that the distinction between leaf and axis is not absolute, an intermediate condition, stachyophylls, being suggested to embrace "cladodia, phyllodia, and the like".

A vista in plant anatomy is given by C. R. Metcalfe. In Plant biochemistry, E. C. Bate-Smith includes sections on biochemistry of the species and on biochemistry and taxonomy; what most impresses the biochemist, we are told, is the uniformity of biochemical processes over the whole range of living matter. Certain substances are, however, restricted to particular groups—chlorophyll to green plants, certain phenolic compounds to vascular plants. Some constituents, notably pigments, have been shown to be under gene control; attention is called to the existence of genera and subgenera in groups such as *Pinus* and *Prunus* where chemical groupings correspond fairly closely to those established by the taxonomists; the taxonomic significance of the alkaloids [cf. 2393–4], of the triterpenes in the Cucurbitaceae, of the phenolic and of many other substances is also mentioned [cf. 99] and no reason is found for fearing that "chemical systematics" will go counter to existing taxonomy except in matters of detail.

Sir E. J. Salisbury writes on Causal plant ecology, J. Braun-Blanquet on Grundfragen und Aufgaben der Pflanzensoziologie [Basic questions and objectives of plant sociology], and W. B. Turrill on Plant geography; the last-named has something to say about vicarious species and subspecies, illustrating the complexity of the situation by reference to *Silene* spp.; he considers that phytogeographers will have to pay attention to many of the questions asked by Willis in his book on *The course of evolution*; the evidence concerning continental drift is re-examined but apparently found still inconclusive. The question of the possible advantages of polyploidy in colonizing unfavourable areas is also regarded as still open.

J. Walton writes on Palaeobotany in Great Britain, and D. G. Catcheside on Plant cytology; this is taken in the wide sense and includes descriptions of the endoplasmic reticulum, mitochondria, plastids and other cytoplasmic constituents revealed by studies with the electron microscope, in addition to descriptions of the fine structure of the chromosomes. Evidence that the DNA molecule constitutes the sole genetic material is examined and other matters considered are the results of studies with microorganisms, suggesting that the information within the gene is disposed in linear fashion, and gene complementation in a heterocaryon.

G. L. Stebbins, writing on Genes, chromosomes, and evolution, calls for caution in speculating on how many and what kind of genetic changes are necessary to originate a new species, genus or other taxon, particularly in view of recent results on the effects of gene dosage. The roles of mutation, genetic recombination, selection and reproductive isolation are examined in turn. Emphasis is laid on the pleiotropic effect of most mutations, on the tendency in many species to develop self fertility in the peripheral areas of distribution, on the relationship between plant and pollinating insect in determining survival of segregates from hybridization, and on the role of introgression and of amphiploidy in speciation; in this last connexion evidence is cited in favour of the author's view concerning the origin of the tetraploid New World cottons, from amphidiploids between *Gossypium raimondii* and *G. herbaceum* in the Tertiary period when the areas of these two species overlapped in North America. Many species thought by the ignorant to be autopolyploids are shown to be alloploids or partial alloploids; an example of this is *Helianthus tuberosus*, classed by

Darlington as an autotetraploid of *H. annuus*. Natural selection is regarded as "the chief and probably the only process which directs evolution". It is shown that many of the characters used by the taxonomist to distinguish species and other taxa, being connected with the reproductive system, have an adaptive significance and can have evolved directly by natural selection.

F. C. Bawden, writing on Viruses, stresses their chemical simplicity, consisting as they do of only two substances, protein and nucleic acid, the latter constituent being the infective unit; the proportions of the purines and pyrimidines in the nucleic acid are constant for any one strain of virus but differ between strains. There are strong reasons for believing that, at least in those viruses that have been sufficiently studied, the protein is separated from the nucleic acid upon infection; it is not known, however, whether the virus moves from cell to cell as nucleoprotein or as nucleic acid. In some viruses there is reason to believe that they multiply within their insect vector too. Many promising fields for further study are suggested.

K. A. Bisset writes on Bacteria, the ancestral type of which is regarded as a polar-flagellate, spiral water bacillus. Claims to have observed a typical mitotic process in bacterial nuclei are regarded with complete scepticism and both Gram-positive and Gram-negative groups are considered as having evolved from a flagellate ancestor.

A contribution on Phycology in retrospect and anticipation comes from W. R. Taylor and one on Fungi from C. T. Ingold, who traces the development of knowledge on sexuality and heterothallism in various fungus groups and outlines many recent genetical studies, the spectacular developments in this field being contrasted with the paucity of information on fungal cytology. Physiological studies are also reviewed, and there are sections dealing with fungi of special habitats and with taxonomy; any attempted phylogenetic tree is regarded as premature and, in fact, "the most noxious of all weeds".

P. W. Richards writes on Bryophyta, R. E. G. Pichi-Sermolli on Pteridophyta and W. B. Turrill on Gymnospermae, describing the main fossil groups as well as the existing forms, which are, it seems, not of monophyletic origin.

The final essay, by F. W. Went on Plant physiology, seems to be directed to a less informed public than the other essays in the volume and is, furthermore, provided with no bibliography.

4702 WITHNER, C. L. (Editor)
**The orchids. A scientific survey.**
Ronald Press Co., New York 1959 : $14.00 : Pp. ix + 648 : figs. : tables : plates.

A volume devoted to a single subject and made up of contributions by different authors is almost always of some value, if only because of the interest arising from the diverse treatments of the same theme by the individual contributors. The present volume is one of the more valuable of its kind, for it is packed with information on the botany and history of orchids and should thus be useful both to pure botanists and to orchid growers. Professor Withner contributes the introductory chapter on the history of orchidology. This is followed by Charles Schweinfurth's survey of the history of the classification of orchids. He outlines the classificatory schemes proposed by various authors and provides an extensive bibliography of the more important monographs and floras, arranged according to the geographical regions they cover. S. Shushan writes on the Developmental anatomy of an orchid, *Cattleya* x Trimos. H. H. Adams describes in some detail and with numerous line illustrations the main types of variation in habit and flower form and expresses the view that introgressive hybridization has played a large part in the development of present-day taxa. In Embryology and development in the Orchidaceae, M. Wirth and C. L. Withner survey the types of microsporogenesis, megasporogenesis, pollination, fertilization, embryogeny and apomixis occurring in the group. Cytology in the Orchidaceae is dealt with in a comprehensive and detailed paper by R. E. Duncan, in which the author discusses techniques of study, cytoplasmic structures, interphase nuclei, chromosome morphology and number and meiotic behaviour in species and hybrids. In Hybridization and inheritance in orchids, L. W. Lenz and D. E. Wimber consider *inter alia* natural and artificial hybridization, possible causes of reciprocal differences in crosses, examples of apomixis, polyembryony and sports, and the inheritance of flower colour; they include a list of the intergeneric hybrids produced by various workers since about 1860. Both these authors and R. E. Duncan are of the opinion that the potential uses of orchids in the study of polyploidy, wide crosses and inheritance have as yet hardly been touched. The next three chapters are concerned with physiology. That by C. L. Withner, entitled Orchid physiology, deals with the physiology of growth and reproduction; H. Burgeff, the

translation of whose paper could be improved upon, gives an account of the Mycorrhiza of orchids; and G. B. Rotor, Jr., describes The photoperiodic and temperature responses of orchids. Fungal and bacterial diseases, virus diseases and pests are dealt with in the following three papers by P. A. Ark, D. D. Jensen and A. E. Pritchard, respectively, and the main body of the book concludes with a chapter on vanilla, by N. F. Childers, H. R. Cibes and E. Hernández-Medina. In this chapter it is noted that interspecific crosses made with the aim of obtaining varieties resistant to *Fusarium batatatis* var. *vanillae* are in progress in Puerto Rico.

There is an appendix with four sections: the first giving keys to the tribes and subtribes; the second listing chromosome numbers in species and hybrids; the third giving recipes for culture media and nutrient solutions; and the last outlining smear techniques for chromosome counts. Finally there are indexes of persons, plant names and subjects.

There are some gaps which might well have been filled. For example, a more purely taxonomic survey than C. Schweinfurth's largely bibliographical chapter would have been welcome, and some information on the geographical distribution and the ecology of orchids would surely be of interest. Nevertheless, this is altogether a useful and sufficiently comprehensive book, containing much that will be of value for years to come.

4703 **Utilization of nitrogen and its compounds by plants. Symposium of the Society for Experimental Biology. No. 13.**

Cambridge University Press 1959 : 50s. : Pp. vi + 385 : figs. : tables : plates.

The thirteenth symposium [cf. 4928] was held at the University of Reading from 15 to 19 September 1958. Most of the contributions will be of direct or indirect interest to plant geneticists.

D. J. D. Nicholas, in Metallo-enzymes in nitrate assimilation of plants, with special reference to microorganisms, shows the unique role of molybdenum as a constituent of the enzyme responsible for nitrate reduction, some of the evidence for which has come from *Neurospora* mutants unable to grow on nitrate N. The nitrite reductase on the other hand is a flavoprotein dependent on Fe and Cu for its activity, though there are mutants requiring pyridoxine; there is however no convincing evidence that the organic reductive sequence involving either the oxime route to aminoacids or the reduction of aromatic nitro-compounds has assimilatory significance in plants. In Some observations on the chemistry of biological nitrogen fixation, E. R. Roberts considers some possible mechanisms of fixation that involve an initial oxidative step rather than the direct reduction that has so often been assumed.

P. S. Nutman, in Sources of incompatibility affecting nitrogen fixation in legume symbiosis, presents data on nodule size in red clover and subterranean clover and on its inheritance; it is apparently determined entirely by the genetic constitution of the host plant. Tables are given showing the behaviour of different bacterial strains on the main species of *Trifolium*; it is seen that effectiveness and ineffectiveness of strains are not absolute qualities but have a meaning only in relation to any given host species or line. A number of lines of red clover selected for differences in reaction to one bacterial strain often showed no difference whatever in reaction to other strains; the same applies to various mutant types occurring in the bacterium. Inbreeding leads to a general decline in effectiveness in symbiosis. The results reported seem to prove that bacteroid formation involves very specific interactions between plant and bacteria and that different genes exert their effect at different stages in this interaction, so that a graded series of degrees of ineffectiveness can be drawn up. Two mutant strains of bacterium in subterranean clover are also described, each being ineffective in a different way.

Fixation of nitrogen in non-legume root-nodule plants is treated by G. Bond [cf. 2122]; experiments on nodules from *Alnus* and *Myrica* exposed to $^{15}N$ are reported which showed that a large part of the fixed N accumulates in the former as citrulline and in the latter as glutamine, the amide N being several times more highly labelled than the amino N. These results are taken as "pointing to the involvement of ammonia" in the fixation.

Observations on Lincoln soya bean inoculated with two strains of *Rhizobium japonicum* are reported by J. E. Falk, C. A. Appleby and R. J. Porra in The nature, function and biosynthesis of the haem compounds and porphyrins of legume root nodules; strain 505 produces large effective nodules rich in leghaemoglobin, strain 507 produces small ineffective nodules without leghaemoglobin. The results suggest that the ineffective nodule, while having the enzymes necessary for the synthesis of protoporphyrin, lacks a necessary heat-stable material, which the effective nodules as well as yeast cells

possess. Analogies are drawn between the nodule and the mammalian erythrocyte.

In Reduction of nitrate by green algae, E. Kessler dealt with the formation and reduction of nitrite by *Ankistrodesmus braunii*, and the curious way that this is influenced by light; it seems that the action of light is a complicated phenomenon contributing to the supply of hydrogen donors, of energy-rich phosphate bonds, and of carbon compounds.

G. E. Fogg spoke on Nitrogen nutrition and metabolic patterns in algae. In The position of amino acids in the assimilation of nitrogen and the synthesis of proteins in plants, B. F. Folkes reviewed work carried out on *Torulopsis utilis* and *Hordeum distichon* and could find little ground for an alternative hypothesis to the view that aminoacids are formed directly from the assimilation of N and are precursors of protein. F. C. Steward *et al.*, speaking on Nutritional and environmental effects on the nitrogen metabolism of plants, presented data on the effect on N metabolism in *Mentha piperita* of various factors such as photoperiod, mineral deficiency and night temperature. In The utilization of amino and amide nitrogen by *Endomycopsis vernalis* and other yeasts (with special reference to metabolic reactions at the surface of the cells), M. Steiner showed that the organism utilized amide N more rapidly than amino N, striking differences being observed in the rate of utilization of closely related aminoacids, indicating that the enzymic apparatus is highly specialized. Some notable differences were observed in the metabolic processes of *Endomycopsis* and those of *Torulopsis*, the latter being able to utilize fatty acid amides and benzamide, the former not; moreover, urea and a number of other amides are utilized by both yeasts but the former produces ammonia in the process whereas the latter does not.

A. W. Naylor, in Interrelations of ornithine, citrulline, and arginine in plants, showed that all three play an important role in the nitrogen metabolism of green plants and the view is expressed that knowledge of how arginine synthesis and utilization is regulated will provide important clues of general value in understanding how growth is regulated naturally. J. K. Miettinen, in Assimilation of amino acids in higher plants, presented evidence that these are taken up direct by some species, without deamination at the root. Experiments carried out with whole plants often gave quite different results from those with excised shoots. V. S. Sokolov, in The influence of certain environmental factors on the formation and accumulation of alkaloids in plants, presented data on the families of Engler's system that are known to contain alkaloids, summarized some of the work on alkaloids carried out in Russia in the nineteenth and twentieth centuries and gave a more detailed account of investigations on the effect of various external and internal conditions on the alkaloid content in a number of different species. New perspectives in the biosynthesis of alkaloids were discussed by K. Mothes, special reference being made to the relations of certain aminoacids and enzymes to certain particular alkaloids; the ultimate objective, to elucidate the relationship between chemical structure and systematic classification, is seen as a distant goal. L. Fowden reported on Amino acids of plants with special reference to recently discovered acids, confining his attention largely to the nonprotein aminoacids, forming part of the free aminoacid complement of plants, that have been discovered recently by the use of chromatography; the great variety in their structure is a further indication of the surprising ability of higher plants to effect complex chemical syntheses involving the nitrogen atom.

E. G. Bollard spoke on Urease, urea and ureides in plants, G. C. Webster on The biosynthesis of amide and peptide bonds, R. L. M. Synge on Non-protein chemically bound forms of amino acids in plants, and D. D. Davies, J. Hanford and A. P. Wilkinson on The metabolism of aspartic acid, serine and glycine in higher plants. The final contribution in the volume is on The nucleic acids and plant growth and development, by J. K. Heyes, who described experiments in which tips of pea roots were grown in the presence of 8-azaguanine, which inhibited cell division and the synthesis of protein; it was apparently incorporated into the RNA and reduced the activity of various enzymes studied, a finding which is taken as being consistent with the hypothesis that protein synthesis is mediated by RNA. A further set of experiments indicated that the roots contain two RNA fractions, one more tightly bound than the other, and that the proportion of the bound form, thought to be metabolically less active, increases with the age of the cells.

4704 Machlis, L. & Torrey, J. G. (Editors). **Annual review of plant physiology. Vol. 10.**
Annual Review, Inc., Palo Alto, California 1959 : $7.50 : Pp. vii + 483 : figs. : tables.

The tenth volume of this valuable series [cf. 911]

begins with a prefatory chapter on Plant physiology and horticulture by W. H. Chandler. There is a contribution on Photoperiodic control of floral induction, by J. Doorenbos and S. J. Wellensiek, who review a large body of literature showing the complicated interaction of both light and temperature in controlling this apparently simple process. Much still remains unknown and plants of the same species differing in as little as one single gene may show different responses.

N. T. Mirov and R. G. Stanley write on The pine tree, reviewing some of the recent physiological studies made on the many species of *Pinus*, and F. C. Bawden writes on Physiology of virus diseases; evidence is reviewed which indicates that the intact virus particle is not the minimal infective unit, though the nucleic acid component is shown to be essential; the specificity of virus strains seems however to reside in the protein constituent. In Light-induced reactions of bacterial chromatophores and their relation to photosynthesis, A. W. Ernekel reviews information on the composition and structure of bacterial chromatophores and their function and finds many similarities between them and chloroplasts in carrying out phosphorylation. J. J. Wolken reviews The structure of the chloroplast. There are also reviews on Leaf proteins, by N. W. Pirie, on The chemical regulation of growth, by F. C. Steward and E. M. Shantz, on Auxins and fungi, by H. E. Gruen, and on Phototropism and phototaxis, by J. Reinert.

4705 Daubenmire, R. F.
**Plants and environment.**
John Wiley & Sons, Inc., New York & Chapman & Hall, Ltd., London 1959 : 2nd Ed. : 56s. : Pp. xi + 422 : 92 figs. : 14 tables.

In this new edition [cf. XIX, p. 431], every chapter has been revised and has received some additions and the bibliography has been extended from 612 to 773 titles; the sequence of chapters remains the same. The new material embodied in the text includes a brief discussion of soil toxins, further details on methods of evaluating precipitation as an ecological factor, information on urban microclimate and the effects of smog upon vegetation, an account of frost churning of soils and additional examples of fire-resistant plants. The photographs remain the same with some additions, and complete resetting has allowed even further improvements to be made in the lay-out, which was favourably commented on in our review of the first edition.

4706 Hutchinson, J.
**The families of flowering plants. Vol. I. Dicotyledons. Vol. II. Monocotyledons.**
Clarendon Press: Oxford University Press. 1959 : 2nd Ed. : 147s. : Pp. xi + 510 and viii + 792. : 450 figs. : maps.

The publication of Hutchinson's two volumes on *The Families of Flowering Plants* in 1926 was a notable event since it effectively disturbed the complacent Englerianism which lay on angiosperm taxonomy with all the dead weight of a classical tradition. The principal differences between the systems of Engler and Hutchinson were: (1) the latter regarded absence of a perianth as secondary while the former regarded it as primitive; (2) sympetaly was regarded by Hutchinson as of polyphyletic origin; and (3) Hutchinson regarded the primary division in the dicotyledons to be between fundamentally woody and fundamentally herbaceous plants.

The second edition of Hutchinson's work, published by the Clarendon Press instead of Macmillan, is a considerably expanded and thoroughly revised version of the earlier publication. The distinctive tendencies of the first edition are even more strongly emphasized. In particular, the dicotyledons are now firmly dichotomized into the Lignosae and the Herbaceae. The number of angiosperm families has been considerably increased and now exceeds 400; several are here defined for the first time. This increase is likely to commend itself to most general taxonomists as it results in families of much greater homogeneity. Some drastic reallocations of families within the orders have been made. In the first edition, the Verbenaceae and Labiatae are adjacent members of the Lamiales; in the second these two families have no common ancestor above the proangiosperm level.

A useful addition is provided by the separate keys to families within each order. For many of the smaller families, keys are also provided to the genera so that the volumes partially fulfil the role of a *Genera plantarum*. Another new feature is a brief history of angiosperm classification.

The characteristics which especially commend both the present and the previous edition are the clarity of the family descriptions and the well-drawn illustrative diagrams. These features enable the author's almost unrivalled knowledge

of tropical plants to be effectively utilized. Equally valuable are the author's iconoclastic treatment of previous systems and his insights into the taxonomic importance of such characteristics as woody habit and type of inflorescence, the latter utilized in a generally approved reclassification of the Liliaceae and Amaryllidaceae.

The misgivings, however, which the earlier edition evoked, remain. Taxonomy is no longer a matter of floral morphology. The author admittedly alludes to an occasional anatomical feature in support of this or that conjecture, but it is hard to conceive how an appreciation of anatomical evidence could result in the association of the Polygonaceae and the Illecebraceae in a single order, or in the juxtaposition of the Ranunculaceae and the Paeoniaceae. Too often the reasons for the taxonomic groupings are tenuous or result from excessive attachment to the distinction between woody and herbaceous habit. Occasionally the reasons for a particular arrangement seem to derive from a rather antiquarian veneration for Bentham and Hooker. Such important taxonomic tools as chromosome number are not used and the whole work is bathed in an optimism as to the possibilities of discerning phylogenies which can only aggravate the agnostic.

It is unlikely that a generally acceptable classification of the angiosperms will emerge till someone or his electronic computer digests not only the present range of knowledge on floral morphology but also the many other aspects, such as anatomy, biochemistry and chromosome constitution, that have been shown to be of taxonomic relevance. Till that day, we may be grateful to the present author for an arrangement which, in many respects, is inferior to none.

4707 Moser, H.
**The dynamics of bacterial populations maintained in the chemostat.**
Carnegie Institution of Washington Publication 614 : 1958 : Pp. 136 : 47 figs.

Under the controlled culture conditions in the chemostat, in nonsexual bacteria, the sole factors influencing the genetic composition of the population are mutation and selection and this system has therefore been chosen for a detailed study of the growth of various bacterial strains at reduced concentrations of certain nutrients. Equations are worked out to express the change that occurs in the population when a mutant replaces the original strain. In cases where the population changes over completely from the strain S to a mutant strain $SX_F$ ($f = 1$), which grows faster at limiting concentrations of the controlling growth factor than strain S, the concentration in the culture vessel decreases from the initial value $\tilde{c} \cong c^*$ to a lower value $\tilde{c}_f = c^{**}$; the total population density, on the other hand, $D(t) = (1/\bar{q})[a - c(t)]$, increases during the change-over from the initial value $\tilde{D} \cong (1/\bar{q})(a - c^*)$ to a higher value $\tilde{D}_f = (1/\bar{q})(a - c^{**})$. Thus we have a situation in which a spontaneous change in the genetic composition of the population induces changes in the external environment of the individuals that compose the population, and these induced changes in turn affect the metabolic-process rates, the selective values, and the total number of organisms in the culture.

The accumulation of mutants belonging to categories other than the prevalent mutant variety is controlled by mutation, by specific selection, and by nonspecific or periodic selection, and is therefore of a complex nature. Formulae are calculated to express the effect on such rarer mutants of the change-over from the original strain to a faster-growing strain. These expressions predict various accumulation curves which show the characteristic shifts or oscillations related to population change-overs.

4708 Poehlman, J. M.
**Breeding field crops.**
Henry Holt & Co., Inc., New York 1959 : $8.50 : Pp. 427 : figs. : tables.

This text book is designed for students and is based on a course on Crop Breeding at the University of Missouri. The first chapter gives an outline of some of the directions in which agricultural plants have been improved by breeding and of the methods used, the examples cited being chiefly of work carried out in the USA. In chapter 2 the chief modes of reproduction in plants are described and illustrated with the aid of some excellent photographs and diagrams. The basic principles of cytology are included in this chapter and the chromosome numbers are given for some of the main crop plants of North America. Genetical principles are expounded in chapter 3, which includes discussions of the nature of heterosis, the value of induced mutations and the use of polyploidy, interspecific crossing and gene substitution. Methods of breeding field crops form the subject of chapter 4, self-pollinated crops being dealt with first, and an account is given of the

successful work on plant introduction carried out in North America by Government and other agencies. The breeding methods described include selection, hybridization and back crossing, which are treated again under cross-pollinating crops; the use of irradiation and polyploidy receives further mention in this chapter. The actual techniques employed in crossing and in testing for various resistances are dealt with in detail in chapter 5, after which there follows a series of chapters each dedicated to the breeding of a particular crop or group of crops. The information given includes details on the origin of the species, their classification and chromosome numbers, methods used in their genetic improvement and the main results of breeding for such features as yield, quality and resistance to a series of diseases and pests; here again the matter is confined very largely to work done in North America. A final chapter deals with seed production (in North America) and the volume ends with a glossary of technical terms used in the text and a subject index.

4709 STUBBE, H.
Einige Ergebnisse der Mutationsforschung an Kulturpflanzen. (**Some results of mutation studies with cultivated plants**).
SB dtsch. Akad. Wiss. Berl., Klasse Medizin 1959 : DM 2.20 : No. 1 : Pp. 32 : 7 figs. : 8 tables : 7 plates.

A number of useful mutants obtained from irradiation are referred to from the literature and others obtained at the research institute at Gatersleben, E. Germany, are described. These include an unbranched form of *Antirrhinum majus* from which a tall unbranched garden type has been bred; several barley mutants already described [cf. XXVIII, 1653, XXIX, 365, 2644]; early-ripening soya-bean mutants with greater yield; soya-bean mutants that germinate at lower temperatures; early-ripening tomato mutants; tomato mutants with over double the normal tomatin content and others containing demissidin, not previously known to occur in tomatoes; still others containing $\beta$-tomatin; and finally red-skinned forms of the apple Weisser Klarapfel [White Klarapfel], which have never been found as natural mutants in spite of continuous searching during the last forty years.

The author concludes that the method of irradiation forms a useful adjunct to other methods of plant breeding.

4710 34e beschrijvende rassenlijst voor landbouwgewassen 1959. (**34th descriptive varietal list of agricultural crops, 1959**).
Rijkscommissie voor de Sammenstelling van de Rassenlijst voor Landbouwgewassen, Wageningen 1958 : f. 2.00 : Pp. 336 : tables.

The present edition of this useful book follows the same plan as its predecessors [cf. XXVIII, 3574]. Covering all the main crops grown in the Netherlands, it lists and provides descriptive notes on all the most important varieties. Information on the parentage of each variety is included, together with the names and addresses of the breeder and the organization from which propagating material may be obtained. The English supplement contains translations of the terms used in the tables appearing under different crop headings and a glossary at the end of the book provides the Latin, German, English and French equivalents of Dutch crop names.

4711 **Detailed descriptions of varieties of wheat, barley and oats recommended by the National Institute of Agricultural Botany.** Supplement 1959 : unpaginated.

A further supplement to the handbook published in 1954 has been issued [cf. XXV, p. 456]. It consists of revisions of the lists of wheats, oats and barleys, together with detailed descriptions of the following: the winter wheat Flamingo, selected from (Tassilo x Kron) x Heines IV by F. Heine, Schnega, Hanover, Germany, and first distributed in 1957; the spring wheat Jufy 1, developed from Jubilegem x Fylgia at the State Agricultural Plant Breeding Station, Gembloux, Belgium, and first distributed in 1954; and the winter oat Penrhyn [cf. 3752].

4712 SPRAGUE, H. B. (Editor)
**Grasslands. A symposium presented at the New York meeting of the American Association for the Advancement of Science, December 27-30, 1956.**
American Association for the Advancement of Science, Washington & Bailey Bros. & Swinfen Ltd., London 1959 : 82s. : Pp. xv + 406 : figs. : tables.

The 1956 meeting of the Agriculture Section of the American Association for the Advancement of Science provided the occasion for a comprehensive review of information on grasslands in the USA and of their role in the national

economy. Eight of the sessions had the purpose of reviewing various topics while in the remaining five, papers reporting on new research were submitted. This volume contains the review contributions, numbering 37 in all. Throughout, the broad front of grassland research has been kept well in mind. The collection of articles should thus be especially welcome to scientists seeking information outside their own fields of specialization. The eight sessions were respectively devoted to: (1) Sciences in support of grassland research, (2) Forage production in temperate humid regions, (3) Engineering aspects of grassland agriculture, (4) Forage utilization and related animal nutrition programs, (5) Evaluation of the nutritive significance of forages, (6) Grassland climatology, (7) Ecology of grasslands and (8) Range management. Contributions to the first session include Plant exploration and the search for superior germ plasm for grasslands by J. R. Harlan, who stresses that a well-executed search for such material must inevitably be selective and that the principles of ecology, taxonomy, genetics and plant geography should all be brought to bear upon the development of such a project. Also in this section is Integration of programs in genetics, pathology, and entomology by M. G. Weiss, illustrating the desirability of work on a team basis among specialists in the relevant fields. To the second session, A. A. Hanson contributes Development and use of improved varieties of forage crops in the temperate humid region. Two other reviews, part of the last session, may also be mentioned for their direct interest to breeders: Breeding improved forage plants for western ranges by W. Keller, and Testing new range forage plants by J. L. Schwendiman. The latter writer provides a useful guide to the procedures and organization of the cooperative testing of native and foreign introductions and breeders' material of grasses and other plants for various conservation purposes, as well as to the steps involved in the release and multiplication of varieties. The Plant Materials Center, Pullman, Wash., forms the headquarters of this important scheme of testing.

4713 Kidner, A. W.
**Asparagus.**
Faber & Faber Ltd., London 1959 : 2nd Ed. : 25s. : Pp. 184 : figs. : tables : 17 plates.

The first edition of this lively book for growers appeared in 1947. The comments of praise and criticism given in the review of the first edition remain applicable to the second [cf. XVIII, p. 403]. Chapter 12, entitled Asparagus and the commercial grower, has been largely rewritten. Chapter 13, dealing with Some recent developments, is entirely new and discusses modern methods of cultivation and, very sceptically, the possibility of producing all-male strains, as suggested by Sneep on the basis of his genetical studies of sex in the crop at the Institute for Horticultural Plant Breeding, Wageningen. To the author the development of such strains would be tantamount to recreating "a nearly extinct monosexual species". He is emphatically of the view that breeding specifically for improved quality by the ordinary pedigree method would be much more practicable and less expensive, as well as less contrary to the intention of the "Creator [who] developed asparagus as a bisexual species". Many incidental additions of interest, particularly to those engaged in bulk cultivation for processing, have also been incorporated. The bee-in-the-bonnet method of presentation, with its personal asides and flights of rustic philosophizing, do not seriously detract from the usefulness of the book on many practical points. But Mr. Kidner disarms the reviewer (and changes the metaphor): "Bats in the belfry . . . you say? Perhaps, but it's better to be that way alive, than to be without them and dead, as you would be."

4714 Hilton, R. N.
**Maladies of Hevea in Malaya.**
Rubber Research Institute, Kuala Lumpur 1959 : M$30 : Pp. 101 : plates.

This book, which is intended for the use of rubber planters in Malaya, is concerned chiefly with the recognition of disorders. After a short general introduction dealing in turn with the recognition of symptoms, types of pathogen, alternative hosts, spread of diseases, prevention and treatment, there follows the main body of the book, comprising descriptions and illustrations of 41 diseases, arranged under the headings of the whole plant, the root, the stem and branches, the tapping panel, the leaf of the young plant, the leaf in general and the leaf of the mature plant. Each individual description follows the same arrangement as the introduction and includes both English and Malay vernacular names as well as the scientific names of the diseases. Control measures are not treated in great detail since these change as techniques improve and accounts of them are available in the regular publications of the Rubber Research Institute of Malaya. Instead,

the emphasis is on recognition and identification of the diseases, and to this end the descriptions and coloured illustrations have been prepared with obviously great care. The illustrations, by Hoh Choo Chuan, are indeed remarkably fine, being not only detailed and clear but executed with an eye for colour and arrangement that is all too rare in a work of this kind. The reproduction is also good, and altogether this is a handsomely produced book, with the unusual virtue of combining utility and beauty.

4715 WATSON, W. C. R.
**Handbook of the Rubi of Great Britain and Ireland.**
Cambridge University Press 1958 : 63s. : Pp. xi + 273 : 50 figs.

In 1822, Weihe and Nees von Esenbeck initiated the tradition by virtue of which the microtaxa within the Linnaean species *Rubus fruticosus*, the blackberry, received Latin binomials indicative of specific status. This method of treatment became well established in western Europe. In Great Britain, too, Babington and Rogers wrote *Rubus* monographs in the same spirit, and in the present volume, published more than fifty years after Rogers's *Handbook of British Rubi*, the tradition reveals its continuing vigour.

W. C. R. Watson was, till his death in 1954, the acknowledged authority on British *Rubi*. The present work, nearly completed before he died, has been seen through the press by O. P. Sell and J. E. Woodhead. The book falls into unequal parts, a preamble and the systematic descriptions.

In the preamble, the author energetically defends the multiplicity of *Rubus* species, pointing out rightly enough that there is no *a priori* reason why a genus should be small in respect of number of species. Moreover he curtails the number of species somewhat by pointing out on p. 4 that some are no more than environmentally-induced fluctuations of others and he deprecates in some cases the attachment of specific epithets to hybrids of poor fertility.

It is impossible however to assess the propriety of any taxonomic treatment today without inquiring into the genetic and cytological background. In the case of *Rubus*, this has been admirably done in Å. Gustafsson's monograph, published in 1943 [cf. XVII, 1306]. Watson's treatment has been but slightly influenced by such developments. He records chromosome numbers when known but his definition of a species, a taxon possessing "constant and inheritable characters running all through the plant and distinguishing it from all other species", is vague and inadequate and could apply equally well to varieties or forms or physiological races. The allusions made to genetics and cytology inspire some misgiving. The author appears to dislike the notion that his species may be clones and states on p. 10 that "clones do not produce variations" which an acquaintance with any clonally-propagated plant would show to be untrue. The important question of the role of diplospory in giving rise to variation within the maternal genotype is not discussed though this phenomenon was first reported in *Rubus* twenty years ago [IX, 954].

The principal part of the book, the specific descriptions, presents the most detailed account available of the range of variation of the genus in the British Isles. It is not easy to use for purposes of identification, and, though synopses are provided, keying is only applied here and there and seldom down to a particular species. The arrangement is based on that of Focke but with many modifications. Nearly four hundred species are recognized and each of these is fully described, together with an account of its vicecomital distribution in the British Isles and its occurrence elsewhere. Fifty excellent drawings of representative taxa by R. M. Ball and A. W. Darnell provide a useful addendum to this part.

As may be inferred from what has been already said, the status of the species described is far from uniform. On the one hand there are taxa such as the diploid *R. ulmifolius*, which combines a distinctive set of morphological characters with a widespread distribution in western Europe, north Africa and the Atlantic islands; on the other, there are taxa whose erratic appearance in a few isolated vicecounties in the British Isles and a few scattered stations on the European mainland suggests the polyphyletic occurrence of maternal segregates in some more widely ranging taxon.

The traditional approach to *Rubus* systematics can no longer afford more than a preamble to more fundamental cytogenetic investigations. So regarded the present volume can be cordially recommended.

4716 HARLOW, W. M.
**Fruit key and twig key to trees and shrubs.**
Dover Publications, Inc., New York & Constable & Co., London 1959 : 10s : Pp. 56 : photos.

Thirteen years ago the author, who is Professor of Wood Technology, State University of New

York, compiled *Twig Key to the Deciduous Woody Plants of Eastern North America* for the use of his students and others. Acting upon the suggestion that a similar key to fruits might be useful, he later produced a key based on these. The two keys now appear together in a handy, glossy paperback, providing the novice with a rapid and simple means of tracking down the names of trees and shrubs in the region. In several genera, e.g. *Salix*, *Malus* and *Crataegus*, no attempt has however been made to separate the various species since in such cases this would be too complicated an undertaking in view of the primarily instructional aim of the guides. Over 350 small but clear photographs offer a check on the identifications arrived at by following up the clues in the dichotomous keys.

4717 Dimpflmeier, R.
Die Bastardierung in der Gattung *Larix*. (**Hybridization in the genus *Larix***).
Beihefte Forstwiss. Cbl. 1959 : DM 16.50 : No. 12 : Pp. 75 : 16 figs. : 12 tables.

In the historical introduction the author of this monograph recognizes the poplar crosses of A. Henry and the interest aroused by the Dunkeld larch as the real beginning of forest-tree breeding. There follows a description of some observations made on 100 plants of the Dunkeld larch planted in 1927 in the vicinity of Munich together with an equal number of seedlings of *L. europaea* and *L. leptolepis*. In 1935 the Dunkeld larches had 61% survivors, *L. europaea* 44% and *L. leptolepis* 28%; in 1948 the figures were 55, 33 and 23% respectively. The Dunkeld larches were taller, and had their density not been higher than that of the two parental species the differences in their favour would have been more pronounced. Though the diameter at breast height was intermediate between the two species, the product of this by number of plants gives a value of 281 for the Dunkeld, 100 for the European and 166 for the Japanese larch. Records of individual trees indicated that the superiority of the best hybrids showed no sign of diminishing over a period of 22 years, this superiority being maintained in respect of both height and diameter.

The seedlings received as Dunkeld larch, being the product of open pollination, were not all hybrids; about 60% proved intermediate in most characteristics, with features of the Japanese larch somewhat predominating. Trees of *L. leptolepis* and the hybrids remained free from *Dasyscypha willkommii* whereas 37% of the European larches were attacked. The Japanese larch is 3–7 days later in flushing than the European, and the hybrids had a complete range of flushing times between these two; about 7% of the hybrids, while resembling the Japanese larch morphologically, correspond to the European type in phenological behaviour.

In 1941 and 1942 a number of crosses were made between the European, Japanese and hybrid larches in various combinations. The mean cone weight in crosses of *L. europaea* x *L. leptolepis* was 5·3 g. compared with 3·6 g. in the reciprocal crosses and 4·3 g. in *L. europaea* x *L. europaea*. The hybrids, when open pollinated, had a 1000 seed weight of 6·23 g. compared with 5·04 g. in *L. europaea* and 5·99 g. in *L. leptolepis*. When the seeds were sown, those from the hybrids had a survival of 22%, those of *L. leptolepis* 19% and those of *L. europaea* 3%; this low fertility of the European larch is ascribed to absence of pollinators in the vicinity of the experimental plot. At the age of three years the seedlings of *L. leptolepis* x *L. europaea* were tallest, exceeding those of *L. europaea* x *L. europaea* by 85%; the reciprocal exceeded them by 56%, back crosses of the hybrids to one or other of the parent species 38%, and the progeny of hybrid x hybrid 9%. The seedlings were destroyed in the war and no further data are available.

In 1950 crosses were made between the Schlitz larch (*L. europaea*) and *L. leptolepis* [cf. XXIII, 694]. The seedlings of *L. leptolepis* x *L. leptolepis* were the most damaged by early frosts and those of *L. europaea* x *L. europaea* the least. At the end of the first growing season the hybrids were the tallest and the Japanese larch the smallest and in the following five years the greatest increase in height was always registered by the hybrids *L. leptolepis* x *L. europaea* 'Schlitz', with an increment of 97 cm. in 1954, 98 cm. in 1955 and 116 cm. in 1956; the reciprocal hybrids were next in order. The Japanese larch was later than the European in flushing and the hybrids were intermediate. In growth form the hybrids tended to resemble the species serving as seed parent.

More extensive crosses were made in 1951, using individual trees of known performance as parents. The hybridization technique employed is described. A mean cone set of 62% was obtained, the best sets being given by a back cross of hybrid 11/51 x *L. europaea* 7/51; the lowest set was in the cross *L. gmelini* var. *principis rupprechtii* 5/51 x *L. europaea* 7/51. The highest yield of seedlings was given by the combinations *L. europaea* x *L. leptolepis* cross

16, with 46 seedlings per g. of seed, *L. gmelinii* var. *principis rupprechtii* x *L. europaea* cross 9 with 42, and *L. leptolepis* x *L. europaea* cross 5 with 38. Open pollination usually gave lower seedling yields, largely owing to the absence of sufficient pollinators to effect cross pollination. The majority of the hybrids were taller than the pure species at the end of the first and second years of growth, the next in order of height being the back crosses, except for the open-pollinated seedlings of *L. gmelini* var. *principis rupprechtii* which also grew very vigorously in the early years.

In later years some of the seedlings were transplanted to other places and the observations continued. The losses from transplanting were generally lower in the hybrids than in the pure species, though some crosses had less losses than others; the back crosses however had the greatest losses of all. In 1957 the reciprocal hybrids *L. europaea* x *L. leptolepis*, 7 out of 9 back crosses and the hybrid of *L. gmelini* var. *principis rupprechtii* all exceeded the pure Japanese larch in height; in one test the best hybrid, *L. leptolepis* x *L. europaea*, with a height of 247 cm., exceeded *L. leptolepis* by 35%; at the age of six years the best hybrid, *L. leptolepis* x *L. europaea*, had a height of 440 cm. and a diameter of 4·8 cm.; the mean height of the hybrids *L. europaea* x *L. leptolepis* was 65% above that of pure *L. europaea*, and that of the back crosses 32% above. The hybrids of *L. europaea* x *L. leptolepis* and reciprocal were less damaged by late and early frosts or recovered better from them, whereas hybrids in which *L. gmelini* var. *principis rupprechtii* participated were all very susceptible to frost.

Certain heterotic hybrids were also found among crosses between different individuals within a species; for instance one hybrid of *L. leptolepis* x *L. leptolepis* was 62% above the average for *L. europaea* in height at 6 years of age.

Great variations in growth habit were observed in the back crosses, individuals of superior form as well as a number of defective types being found. The proportion of these latter is not thought to be high enough to cause any trouble in natural regeneration from the hybrids.

Hybrids with *L. gmelini* var. *principis rupprechtii* as pollen parent shed their needles sooner than others. Back crosses showed segregation in respect of this character.

Though in the early years seedlings of *L. gmelini* var. *principis rupprechtii* were taller than the hybrids, they were surpassed in the 5th and 6th years by the hybrids of this species with *L. europaea*.

4718 Bonner, J. T.
**The cellular slime molds.**
Oxford University Press & Princetown University Press, New Jersey 1959 : 32s. : Pp. vii + 149 : 13 figs. : 8 plates.

In a book reviewed earlier in these pages [912], Professor Bonner made extensive use of the slime moulds to illustrate his views on the nature of development. The present book deals exclusively with one group of slime moulds, the Acrasiales, with special emphasis on their value for experiments on morphogenesis.

There are four sections. The first is taxonomic and distinguishes sharply between the Myxomycetes proper, the Plasmodiophorales, the Labryinthulales and the Acrasiales, all of which have been regarded as Myxomycetes in the broad sense. The author argues with probability that all these groups are of independent origin. The Myxomycetes proper and the Plasmodiophorales appear to have arisen from separate flagellate groups; the Labyrinthulales are associated with the alga *Chlorarachnion*; the Acrasiales differ from the other groups in lacking flagellate swarmers and are believed to have originated from soil amoebae. The characteristic feature in the development of the Acrasiales is the aggregation without fusion of numerous previously free-living cells to form a single morphogenetic unit which eventually differentiates into a fructification. The closest formal analogue to this behaviour is to be found in the quite unrelated Myxobacteria.

The second and third sections of the book are devoted to detailed descriptions of the development of selected species and to experiments which throw light on the chemical and mechanical means of developmental regulation. Some excellent photomicrographs illustrate this part of the book.

Geneticists will find the last section of principal interest. In contrast to the preoccupation with sex to which even bacteria and viruses seem to have become prone, there is no satisfactory evidence for any sexual process in the Acrasiales. However, variation occurs and it appears that most isolates of this group consist of two or more genetic strains. These normally co-operate in aggregation and fruiting but it also happens that different strains of a single species may not cooperate, even when thoroughly intermixed; instead they sort themselves out, aggregate separately and form discrete fructifications. Here, we have a close parallel with sexual compatibility and incompatibility. In cultures composed of several strains, characteristics expressed by one strain in isolation

may not achieve expression, an interesting parallel to recessiveness in sexual organisms. Synergistic interaction of mutant strains to undergo the normal development of which each alone is incapable recalls similar cases of synergistic interaction in fungal heterocaryons. Recent studies on parasexual mechanisms in the fungi have done much to moderate the importance attached to sex by conventional neo-Darwinians. The chastity of the Acrasiales will no doubt inspire similar reconsiderations.

4719 Brockhaus ABC der Landwirtschaft. (**The Brockhaus ABC of agriculture**). F. A. Brockhaus Verlag, Leipzig : Vol. 1, A–K 1957 : Pp. 768; Vol. 2, L–Z 1958 : 769–1548 : DM 24.80 : figs. : tables : plates.

The cooperation of a large number of experts in various branches of agriculture has been enlisted in the preparation of this useful agricultural lexicon. It covers a wide field and includes reference to a certain number of prominent personalities who have been connected in some way with agriculture, in addition to definitions of more strictly agricultural terms; thus Mendel, Mičurin, Lysenko, Achard and many others receive objective mention. Under the definitions of crop plants not only the botanical and agronomic features are given but the main cultivars grown in Germany and the chief pests and diseases are enumerated. The main research centres devoted to the subject in the German Democratic Republic are also mentioned under some of the headings. Many of the definitions are supplemented by diagrams or photographic reproductions, some of them in colour, and another useful feature is the indication of the accentuation of words not of Germanic origin. Synonyms are given and certain initials such as ECE are also elucidated. There is a useful system of cross referencing and the two volumes are well printed, though on paper of rather poor quality.

4720 Crescini, F.
Agronomia generale. (**General agronomy**).
Trattati di Agricoltura 1959 : L.it. 4800 : **4** : Pp. 636 : 201 figs. : 148 tables.

This useful treatise on the principles of agriculture is devoted largely to questions connected with the soil, its physical and chemical properties, tilling operations, reclamation, irrigation and manuring. There are also chapters on climate, crop rotation and the weeds of agricultural plants, with a section on the production of pure seed.

## NEW JOURNALS

### *The Egyptian Journal of Botany.*

Published by the Botanical Society of Egypt in collaboration with the National Research Centre under the auspices of the Science Council, this journal contains papers reporting research on botanical subjects, including, as may be seen from the first issue, work of interest to crop breeders and cytogeneticists [cf. **3461** and **3731**]. Further information may be obtained from the Editor, Egyptian Journal of Botany, Egyptian Science Association, Tager Building, 1, Sh. Elhamy, Kasr El Doubara, Cairo.

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